

Title	DIAS Annual Report 1978
Creators	DIAS, Council
Date	1978
Citation	DIAS, Council (1978) DIAS Annual Report 1978. Communications of the Dublin Institute for Advanced Studies.
URL	https://dair.dias.ie/id/eprint/89/

INSTITIÚID ARD-LÉINN BHAILE ÁTHA CLIATH
(Dublin Institute for Advanced Studies)

Records

ANNUAL REPORT

1978

10 Burlington Road, Dublin 4

INSTITIÚID ARD-LÉINN BHAILÉ ÁTHA CLIATH
(Dublin Institute for Advanced Studies)

ANNUAL REPORT 1978

ERRATA

Page 3: Line 16:

Add: Mart de Groot, PhD.

Page 23: Line 27:

Insert after '6-21 ...': April, and 20 November - 1 December.
He visited Providence College, 15-23 ...

Page 26: Lines 19, 20, 21:

Substitute:

*Multipseudoparticles and perturbation theory in large order of
the anharmonic oscillator. Phys.Rev. 18D (1978), 3037-3039.

Vacuum energy density in large orders of perturbation theory for
the scalar Yukawa₂ field theory. Phys.Lett. 80B (1978), 65-67.

Page 32: Line 10:

Insert after 'UCD,': the School of Mathematics at TCD,

Line 22:

Read Fiorentini for Giorentini; and Majorana for Mahorana

Pr1 8385

INSTITIÓID ARD-LÉINN BHAILLE ÁTHA CLIATH
(Dublin Institute for Advanced Studies)

Annual Report of the work of the
Institute and its Constituent
Schools presented by the Council
to the Minister for Education
in respect of the year ended
31 December 1978

Pr1 8385

INSTITIÚID ARD-LÉINN BHAILE ÁTHA CLIATH
(Dublin Institute for Advanced Studies)

Summary of Annual Report
of the work of the Constituent Schools
for the year ended 31 December 1978

School of Celtic Studies

The death in June 1978 of M Louis Paul Nemo (Roparz Hemon) deprived the School of a most distinguished scholar whose work in Breton had greatly enhanced the reputation of the Institute over the last thirty years. The School suffered a further loss through the resignation of Dr B Ó Buachalla in order to take up appointment as Professor of Modern Irish Language and Literature in University College, Dublin.

Research work in various branches of Celtic continued and seminars on Old and Middle Irish texts were held. Eight papers were read at the annual symposium which was held in Spring. The Summer School, which has been organised on a triennial basis since 1969, was held in July and was attended by forty-one overseas students as well as twenty-four from Ireland.

Seven new works were added to our list of publications, bringing the number published since 1942 to over 170. Arrangements were made to continue the joint publication of the Lexique Étymologique de l'Irlandais Ancien by the Dublin Institute and the Centre National de la Recherche Scientifique in Paris.

School of Theoretical Physics

The School continued its research in the areas of general relativity, statistical mechanics and probability, dielectric theory, Lie groups, quantum field theory, high energy physics, and holomorphic functions. A reprint of one book was published, and one number of Series A of the Communications of the Dublin Institute for Advanced Studies, and thirty contributions to journals or scientific proceedings, were published. Members of the School attended twenty-five international conferences, and gave thirty-nine lectures, or series of lectures, in other institutions. Twenty scientists from abroad visited the School.

Events which were continued from the previous year were the Wednesday seminars, the Christmas and Easter symposia, and various weekly meetings in special subject areas held jointly with

the universities. The joint UCD-TCD-Maynooth-DIAS postgraduate course was continued.

The Statutory Public Lecture was given in Trinity College, Dublin, on 21 April by Professor A Trautman (Warsaw); the title was 'Elementary general relativity'.

School of Cosmic Physics

Astronomy Section

Research on period changes in Cepheid variable stars and on Chromospheric data have continued. In studies of asteroid orbits, a criterion of stability has been found which promises to account for the Kirkwood gaps, which have long defied explanation. Other work of the Section concerns triatomic molecules in stellar atmospheres and the construction of a prototype telescope control device using a microprocessor. An office for correspondence on scientific meetings of the International Astronomical Union was maintained throughout the year; the Executive Committee of the Union met in Dublin during August. Finally, progress in restoring fire damage is reported.

Cosmic Ray Section

The group's activities were devoted mainly to the preparation of the ultra-heavy cosmic ray experiment to be undertaken in space in the early eighties. Following the selection by NASA of this experiment from over 200 American and international proposals, an extensive programme of studies and testing was initiated. The object of the experiment is to study the ultra-heavy cosmic ray nuclei up to and beyond Uranium and information obtained will be used to study several astrophysical phenomena including the production of elements in the universe. Preparation and testing of the payload is in progress using extensive facilities at the European Space and Technology Centre and the Berkeley and Manchester accelerators. The experiment will be launched by the NASA Space Shuttle and will remain in orbit for about one year when it will be recovered by a second Shuttle mission. Work was also continued on the study of the primary cosmic ray transcobalt region.

Theoretical studies of high energy nucleus-nucleus collisions were continued. Further studies into the nature of tachyons were undertaken by extending the special theory of relativity to include complex space-time and complex Lorentz transformation.

Geophysics Section

A marine magnetic survey of Galway Bay confirmed the presence of granite throughout which had been deduced from earlier gravity

INSTITIÚID ARD-LEINN BHAILE ÁTHA CLIATH
(Dublin Institute for Advanced Studies)

Annual Report of the work of the Institute
and its Constituent Schools presented by
the Council for the year ended
31 December 1978

In accordance with the provisions of Section 29 of the Institute for Advanced Studies Act, 1940 (No 13 of 1940), the Council of the Institute has the honour to present to the Minister for Education for submission to the Government a report of the work and activities of the Institute and its Constituent Schools for the year ended 31 December 1978.

The general purpose which it is hoped to accomplish is clearly stated in the Act establishing the Institute, namely, the Institute for Advanced Studies Act, (No 13 of 1940) and in the Establishment Orders establishing the three Constituent Schools namely, the Institute for Advanced Studies (School of Celtic Studies) Establishment Order, 1940, the Institute for Advanced Studies (School of Theoretical Physics) Establishment Order, 1940, and the Institute for Advanced Studies (School of Cosmic Physics) Establishment Order, 1947, and need not be referred to here. It is deemed desirable, however, to include in the report for the purposes of record certain particulars about the constitution of the Council of the Institute and the membership of the Governing Boards of the three Constituent Schools on the 31 December 1978.

The report is presented under the following principal heads:-

- I - Constitution of the Council of the Institute and of the Governing Boards of the three Constituent Schools on the 31 December 1978.
- II - Report of the Governing Board of the School of Celtic Studies.
- III- Report of the Governing Board of the School of Theoretical Physics.
- IV - Report of the Governing Board of the School of Cosmic Physics.

I - Constitution of the Council of the Institute and of the Governing Boards of the three Constituent Schools on the 31 December 1978

1 THE COUNCIL OF THE INSTITUTE

Chairman

Professor WB Stanford, MA, LittD, SFTCD.

Ex-Officio Members

Thomas Murphy, MD, DPH, BScPubH, President, University College, Dublin; Francis SL Lyons, MA, PhD, LittD, FBA, Provost, Trinity College, Dublin; George F Mitchell, MA, DSc, President, Royal Irish Academy.

Members appointed by the Governing Boards of Constituent Schools

Professor Brian Ó Cuív, MA, DLitt; TK Whitaker, DEconSc; Professor JT Lewis, BSc PhD; Dr AJ McConnell, MA, MSc, ScD, FTCD; Professor PA Wayman, PhD; Professor EF Fahy, MSc, PhD.

2 GOVERNING BOARD OF THE SCHOOL OF CELTIC STUDIES

Chairman

Proinsias Mac Cana, MA, PhD.

Senior Professors

James P Carney, BA, FilDr; David Greene, MA; Brian Ó Cuív, MA, DLitt.

Appointed Members

Tomás de Bhaldraithe, MA, PhD, DLitt; Gearóid Mac Eoin, MA, PhD; Seán Ó Tuama, MA, PhD; Ernest Gordon Quin, MA, FTCD; Gerard Victory, BA, MusD; Thomas Kenneth M Whitaker, D Econ Sc.

3 GOVERNING BOARD OF THE SCHOOL OF THEORETICAL PHYSICS

Chairman

Albert J McConnell, MA, MSc, ScD, FTCD.

Senior Professors

John T Lewis, BSc, PhD; Reverend James R McConnell, MA, DSc; Lochlainn Ó Ráifeartaigh, MSc, PhD.

Appointed Members

Michael A Hayes, MSc, PhD; Thomas E Nevin, DSc; Patrick Quinlan, BE, DSc, PhD; Thomas D Spearman, MA, PhD (Cantab); Seán Seosamh Tóibín, MSc, PhD; William Wright, MA, PhD, CEng, FICE, FInstProd E, FIEI, FRSE.

4 GOVERNING BOARD OF THE SCHOOL OF COSMIC PHYSICS

Chairman

Edward Francis Fahy, MSc, PhD.

Senior Professors

Cormac Ó Ceallaigh, MSc, PhD; Thomas Murphy, DSc; Patrick Arthur Wayman, PhD.

Appointed Members

Peter Kevin Carroll, MSc, PhD; Brian Henderson, BSc, MA, PhD, FIP; George F Imbusch, PhD, DSc; Reverend Thomas PG McGreevy, MSc, PhD; Patrick Nolan PhD, DSc; Neil A Porter, PhD; Ernest TS Walton, MA, MSc, PhD, DSc, FTCD.

5 ADMINISTRATIVE STAFF

Registrar

Lt Col John P Duggan

Senior Clerk

Maura Devoy

Accounts Clerk

Mary A O'Rourke

Clerks

Angela Stubbs; Noreen Granahan; Desmond Pender.

II - Annual Report of the Governing Board of the School of Celtic Studies for the year ended 31 December 1978, adopted at its Meeting on the 25 May 1979

1 STAFF, SCHOLARS AND EXTERN RESEARCH WORKERS

Professor Emeritus

DA Binchy

Senior Professors

Brian Ó Cuív, Director of the School; James Carney; David Greene.

Professor

Breandán Ó Buachalla (to 30 September 1978)

Assistant Professors

Pádraig de Brún; Fergus Kelly; Rolf Baumgarten.

Research Assistants

Mícheál Ó Siadhail; Malachy McKenna.

Junior Research Assistants

M Katharine Simms; Liam Breatnach.

Research Associates

Proinsias Mac Cana; Heinrich Wagner; Gearóid Mac Niocaill.

Assistant Librarian/Clerk

Máire Breatnach

Technical and Clerical Staff

Máire Uí Chinnseala

Scholars

Virginia Blankenhorn, Christopher McAll, Liam Ó Murchú, Hermann Moisl, Cornelius Buttner (to 30 September); Kim R McCone; Gwenaél Leduc; R Mark Scowcroft; Muireann Ní Bhrolcháin, MJ McCloskey (from 1 October 1978).

Extern Research Workers

Dr Cecile O'Rahilly; Louis Paul Nemo (Roparz Hemon) (died 29 June 1978); Dr Ludwig Bieler; An tAthair Pádraig Ó Fiannachta; Dr Nancy Dorian; Professor Pádraig Ó Riain; Dr Donncha Ó hAodha; Dr Joan Radner; Professor Tomás Ó Concheanainn, Professor JJ O'Meara.

During the year Most Rev Dr Tomás Ó Fiaich resigned from the Governing Board because his duties as Archbishop of Armagh made it impossible for him to attend Board meetings regularly. Dr B Ó Buachalla resigned his post as Professor in order to take up appointment as Professor of Modern Irish Language and Literature in University College, Dublin. The death in June of M Louis Paul Nemo (Roparz Hemon) deprived the School of a most distinguished and devoted scholar whose work on Breton had greatly enhanced the reputation of the School over the last thirty years.

The Summer School, which has been organised on a triennial basis since 1969, was held from July 3 to July 21 and was attended by forty-one overseas students as well as twenty-four from Ireland.

Seven new works were added to our list of publications, bringing the number published since 1942 to over 170. Arrangements were made to continue the joint publication of the Lexique Étymologique de l'Irlandais Ancien by the Dublin Institute and the Centre National de la Recherche Scientifique in Paris.

2 RESEARCH AND EDITING

Professor DA Binchy completed the checking of proofs of Corpus Iuris Hibernici which were passed for press during the year.

Professor Brian Ó Cuív read proofs of Corpus Iuris Hibernici and saw Volumes I-V through their final stages; read and edited eight articles for publication in Celtica XIII and read further articles submitted for publication later; worked on a contribution on 'Irish Language and Literature c. 1700 - 1845' for Vol IV of A New History of Ireland; continued work on a volume to supplement TF O'Rahilly's Dánta Grádha. The following articles were accepted for publication; (i) 'A medieval exercise in language planning: Classical Early Modern Irish' in Papers from the International Conference on the History of the Language Sciences, Ottawa, August 1978; (ii) 'Some versions of the sixth petition in the Pater Noster' in Studia Celtica 14; (iii) 'Metrics and Irish Phonology' in Proceedings of the Conference on Celtic Phonology, Coleraine, 1977. See also sections 5, 6, 7.

Professor James Carney worked on the history of Irish Literature and he supervised the work of Mark Scowcroft and of Dr Hildegard Tristram of Freiburg; prepared an Index for inclusion in the revised edition of Early Irish Literature and History. An article entitled 'Aspects of Archaic Irish' was accepted for publication in Éigse. See also sections 3 and 5.

Professor David Greene continued: (i) the preliminary editorial work on Saltair na Rann to line 4713; (ii) work on the history of the Irish language. The following articles were accepted for publication:- (i) 'Perfect and passive in Eastern and Western Gaelic' Studia Celtica (Jackson Festschrift); (ii) 'Perfects and Perfectives in Modern Irish', Ériu XXX; (iii) 'Tabu in early Irish narrative' Proceedings of Odense Symposium on Medieval Narrative. See also sections 4, 5, 7, 8.

Professor Breandán Ó Buachalla continued: (i) his survey of the manuscript material dealing with the history of the Irish language in Ulster; (ii) his study of the dialect of Cape Clear, Co Cork. He organised and directed the Summer School in July. In September he resigned his post at the Institute on being appointed to the Chair of Modern Irish Language and Literature in University College, Dublin. See also sections 5, 6, 8.

Dr Padraig de Brún worked on: (i) Catalogue of Irish MSS in Cambridge, collated and checked the material which was sent to press; (ii) Catalogue of Irish MSS in TCD (in association with Mrs Anne O'Sullivan); (iii) poems by and concerning Piaras Feiritéar; (iv) materials for a biographical account and edition of the correspondence of John O'Daly; (v) investigation of background of early nineteenth-century Bible Societies using the Irish language, of teachers employed in this work, and of its relevance to a study of the contemporary scribal tradition in Irish. The following articles were accepted for publication:- (i) 'Irish in the prisons, 1822' Éigse; (ii) 'Hugh Beirne, Piper' Ceol; (iii) 'A Fragment of Civil Survey' Journal of Kerry Archaeological and Historical Society; 'Some Cavan Schools and Teachers, 1814-31' Breifne. See also section 8.

Mr Rolf Baumgarten completed the Bibliography of Irish Linguistics and Literature, 1942-71, which is arranged in 12 sections and 205 sub-sections, with 5 indexes.

Mr Fergus Kelly worked on an edition of 'The Old Irish Triads' and commenced work on a book dealing with 'Early Irish Justice'. See also sections 4, 5, 7.

Micheál Ó Siadhail corrected and revised the typescript of Learning Irish - an introductory self-tutor based on the Irish of Cois Fhairrge. An article entitled 'Roinnt athruintí suantasecha i gCanúint Chonallach' was accepted for publication in Ériu. See also sections 5 and 8.

Dr Malachy McKenna completed the preparation of an article entitled 'The Breton of Guéméné-sur-Scorff Part II (continued)' for publication in ZCP and continued work on Part III of the Breton of Guéméné. Work proceeded on an edition of 'The Spiritual Rose'. See also sections 5 and 8.

Dr M Katharine Simms ran an experimental computer analysis of the date, subjectmatter, metre etc of 200 bardic poems and began processing the total identified corpus of such poems (c 2,000) for the purposes of a similar analysis and eventual publication of a descriptive catalogue of these poems, chronologically arranged. To date the earliest five Ms sources and the ascriptions to authors have been noted for over half the total number of poems. Dr Simms did some work on collating the Trinity MS of the Annals of Ulster with the revised proofs of the forthcoming edition. An article on 'The O'Reillys and the kingdom of East Breifne' was accepted for publication in Breifne. See also sections 5, 7, and 8.

Liam Breatnach completed work on his edition of 'Tochmarc Luaine ocus Aided Athairne' which was accepted for publication in *Celtica* XIII and began work on an edition of the text entitled 'The Caldron of Poesy'. See also sections 5 and 8.

Mrs Nessa Doran checked the typescript of Fasc V of *Catalogue of Irish MSS in the National Library of Ireland*; mss G 189-193, 199-200, 208-234 were catalogued for publication in Fasc VI.

Mrs Anne O'Sullivan completed the proof-reading of *Corpus Iuris Hibernici* and commenced the recataloguing of Irish MSS in Trinity College, Dublin. First drafts of descriptions of MSS 1302-5, 1307, 1309, 1316-7, 1319, 1322, 1340 are now available. A note on excerpts from annals relating to Limerick and Killaloe was accepted for publication in *Éigse*.

Miss Virginia Blankenhorn continued work on intonation in the Irish of Connemara and prepared an article for publication. Work on accentual metres in modern Irish progressed. See also section 7.

Mr Christopher McAll worked on the introduction and notes to his edition of *Uraiceacht Becc* and continued work on the *Commentary on the Law of Status* which is to accompany the edition.

Liam Ó Murchú continued work on a definitive text of the 18th century poem 'Cuirt an Mheán Oíche'.

Mr Hermann Moisl continued work on his D.Phil. thesis: *Aspects of the Relationship between Secular and Ecclesiastical Learning in England and Ireland in the Early Post-Conversion Centuries*.

Mr Cornelius G. Buttner worked on Middle-Irish poems concerning Fedlimid mac Crimthain and bardic poems of the Early Modern Irish period.

Mr Kim R. McCone continued work on his D.Phil. thesis on 'Aspects of Indo-European sentence patterns and their role in the constitution of the Old Irish verbal system' to be presented at Oxford. The following articles were accepted for publication:- (i) 'Pretonic Preverbs and the Absolute Verbal Endings in Old Irish' (*Ériu* XXX); (ii) 'The Diachronic Possibilities of the Indo-European "Amplified" Sentence: a Case History from Anatolian' (*Szemerényi Festschrift*). See also sections 6 and 8.

Mr Gwenaél Le Duc worked on an edition and critical study of a text from four manuscripts dealing with the *Life of Genevieve of Brabant* as a subject for a PhD thesis. Work on *The Life of St Julitte* and *The Mirouer a confession* is almost complete. Preparation of a paper on the Breton material in Lhuyd's *Archaeologia Britannica*, to be delivered at the forthcoming Celtic Congress to be held in Galway, progressed. Preparatory work on a 1730 complaint (from one of the Institute's manuscripts) continues. The following articles have been accepted for publication:- (i) 'Commentary and notes to the Latin Grammar in Middle

Breton', (ii) Anglo-Saxon and Brittonic glosses' (Études Celtiques); (iii) 'On a Theatre Play in Brittany in 1562 (Zeitschrift für Celtische Philologie)'.

Mr R Mark Scowcroft conducted research on the hero of early Irish tradition for the first nine chapters of his doctoral dissertation 'The Hand and the Child: Studies in the Northern Hero' and completed five of the chapters. He established texts from LL and YBL of the story of the 'Three Children who spoke at their Birth' with a view to editing them at a later date.

Muireann Ní Bhrolcháin worked on: (i) the editing of both the metrical and prose texts of the 'Bansheanchas', providing translations, a comprehensive Index and a study of the manuscript tradition and inter-relationships of both; (ii) the metrical works of Gilla Mo-Dutu Ó Cassaide, a 12th century poet of Fermanagh and author of metrical 'Bansheanchas'.

Dr MJ McCloskey worked on: (i) the preparation of a book entitled Transformational Syntax and Model Theoretic Semantics: A Case-study in Modern Irish which was accepted for publication by D Reidel & Co, Dordrecht, Holland; (ii) the syntax and semantics of the verbal noun construction in Modern Irish; (iii) field work based on these subjects in the Donegal Gaeltacht.

Dr Cecile O'Rahilly continued preparatory work on the synthesis of researches on Táin Bó Cuailnge. The following articles were accepted for publication: (i) D'fhobair'; (ii) 'Atá (Tá), introducing an answer' for Celtica XIII; (iii) 'Repetition, a Narrative Device in TBC' for Ériu.

The late Louis Paul Nemo (Roparz Hemon) saw Rann 31 (Skein - Soursenn) of the Historical Dictionary of Breton, which was published in Rennes, through the press before his death in June.

Dr Ludwig Bieler, General Editor of Scriptores Latini Hiberniae, read first proofs of his edition of The Patrician Texts in the Book of Armagh which will be published as Volume X in this Series.

An tAthair Pádraig Ó Fiannachta: Clár Lámhscríbhinní Gaeilge: Fascúl 1

Dr Nancy Dorian : East Sutherland Gaelic

Professor Pádraig Ó Riain : Cath Almaíne

Dr Donncha Ó hAodha : Bethu Bríge

Dr Joan Radner : Fragmentary Annals of Ireland

Professor Tomás Ó Conncheanainn: Nua-Dhuanaire III

These authors/editors checked final proofs of their works, all of which were published during the year.

Professor JJ O'Meara prepared for publication the typescript of the late IP Sheldon-Williams' edition of Liber III of Iohannis Scotti Erivgenae Periphyseon (De Divisione Naturae). This material was sent to press in November.

3 STATUTORY PUBLIC LECTURE

A statutory lecture entitled 'Aspects of Archaic Old Irish' was delivered by Professor James Carney at University College, Dublin on 17 November 1978.

4 SEMINARS

Professor David Greene held a weekly seminar on Saltair na Rann during Hilary, Trinity and Michaelmas terms.

Mr Fergus Kelly held a weekly seminar on 'Old Irish Triads' during Michaelmas term.

5 SUMMER SCHOOL

An International Summer School in Celtic Studies was held from 3 - 21 July under the direction of Professor Breandán Ó Buachalla. The following courses were offered:- Modern Irish (Breandán Ó Buachalla and Mícheál Ó Siadhail); Old Irish (David Greene and Fergus Kelly); Welsh (Liam Breatnach and Proinsias Mac Cana); Breton (Malachy McKenna); Mediaeval and Early Modern Irish (Brian Ó Cuív); Irish Literature (J. Carney, Brian Ó Cuív and Katharine Simms).

Sixty-five students registered for the course, forty-one of whom came from overseas:- America (18); Austria (1); Britain (7); Brittany (1); Germany (3); Italy (1); Japan (1); Netherlands (3); Norway (1); Poland (1); Sweden (4).

Twenty overseas students were awarded Study Grants from funds provided by the Department of Education. The awards ranged in value from £60 - £200.

The School was officially opened on 3 July by Dr Tarlach Ó Raifeartaigh, Chairman of the Cultural Relations Committee at a reception in the Institute.

Excursions to places of historical and cultural interest were organised. On Saturday 8 July members of the School went on tour to the Barrow Valley and St Mullins in Co Carlow. On Saturday 15 July an outing took place to the Boyne Valley and the Cooley District of Co Louth.

6 SYMPOSIUM

On 31 March and 1 April a symposium was held for university and college staff and research workers. The following papers were read:-

- | | |
|------------------------|---|
| Muireann Ní Bhrolcháin | : The Manuscript Tradition of the Metrical Bansheanchas |
| Kim McCone | : Pretonic Preverbs and the Absolute Endings in Old Irish |
| Heinrich Wagner | : The development of Insular Celtic |

Heinrich Wagner	: in the light of Areal Linguistics - old and new points
Breandán Ó Buschalla	: An deireadh <u>-iste</u> san aideacht bhriathardha
Pádraig Ó Riain	: Traces of Lug in Irish hagiography
Risteard B Breatnach	: 'Sean-sgéal / sean-scéal'
Brian Ó Cuív	: 'Ná lig sinn i gcathú'
Gearóid Mac Eoin	: Ódar <u>Shaltair na Rann</u>

7 EXTERNAL ACTIVITIES

Professor Brian Ó Cuív attended (i) the Conference and Meeting of the Council for Names Studies in Great Britain and Ireland, Durham, 14-17 April; (ii) the International Conference on the History of the Language Sciences, Ottawa, 28-31 August and delivered a paper; (iii) acted as External Assessor on the Select Committee which met on 12 December to advise the Curators of Patronage of the University of Edinburgh on the Filling of the chair of Celtic.

Professor David Greene attended (i) a symposium in connection with the Treasures of Irish Art exhibition in San Francisco where he lectured on 'Early Irish Literature' on 24 February; (ii) delivered a lecture entitled 'Myth and Motif' in Manchester University on 16 May; (iii) read a paper on 'Tabu in early Irish Narrative' in Odense University on 20 November; (iv) lectured on 'The present state of the Irish language' in the Department of English, Copenhagen University on 22 November.

Mr Fergus Kelly lectured on 'The Old Irish Triads' at University College, Galway on 27 February.

Dr M Katharine Simms attended (i) the Conference of the Group for the study of Irish Historic Settlement, at Clonmel, 28-30 April (ii) Colloquy on 'Medieval Towns', in University College, Dublin, 17-20 May (iii) lectured on 'The Battle of Disert O Dea' to the Military History Society of Ireland at Disert O Dea on 4 June (iv) the Conference of the Economic and Social History Society of Ireland, at Queen's University, Belfast, 15-17 September (v) lectured on 'The Battle of Disert O Dea and the Gaelic Resurgence in Thomond' to the Clare Archaeological and Historical Society, at Ennis on 16 November.

Miss Virginia Blankenhorn lectured on 'Intonation in Connemara Irish' at University College, Galway on 13 February; attended a Seminar on intonation at New University of Ulster at Coleraine 2-4 March.

8 PUBLICATIONS

Difficulties with printers continued in 1978. Despite assurance that work on the Corpus Iuris Hibernici would be expedited,

only two of the six volumes were completed and these will not be published until the full set is available in 1979. Seven new works were published during the year and five reprints. In addition a further fasciculus of the Lexique Étymologique de l'Irlandais Ancien was published jointly by the Dublin Institute and Centre National de la Recherche. 7,000 volumes of the School's publications were sold.

(a) Books published by the Institute

East Sutherland Gaelic	Nancy Dorian	xx + 220pp	£9.00
Clár Lámhscríbhinní Gaeilge	Fascúl 1	Pádraig Ó Fiannachta viii + 175pp	£3.60
Nua-Dhuanaire III	Tomás Ó Concheanainn	x + 123 pp	£3.60
Téarmaí Tógála agus Tís as Inis Meáin	Micheál Ó Siadhail	xiii + 77pp	£3.00
Bethu Brigitte	Donncha Ó hAodha	xxx + 91pp	£6.00
Fragmentary Annals of Ireland	Joan Radner	xxxvii + 241pp	£12.00
Cath Almaine (Mediaeval and Modern Irish Series Vol XXV)			
Edited by Pádraig Ó Riain		xxxix + 86pp	£4.50

(b) Books published outside the Institute

David Greene

Ériu xxix. Published by the Royal Irish Academy and edited by David Greene and Proinsias Mac Cana.

Roparz Hemon

Historical Dictionary of Breton Rann 31 (Skein-Sourseenn)
Published by Preder, Rennes.

(c) Reprints

1. Periphyseon Liber 1
2. Compert Con Culainn
3. Caithréim Cellaig
4. Párlament na mBan
5. Stowe Version of Táin Bó Cualinge

(d) Contributions to periodicals and other publications

David Greene

The é-future in Modern Irish. Ériu xxix. 58-63.

Pádraig de Brún

'A list of poems in Irish associated with the knights of Glin' as Appendix III to JA Gaughan, The Knights of Glin, a Geraldine Family (Dublin) 1978. 148-50.

An Irish class of 1845. Éigse xvii. 214.

Lámhscríbhinní Gaeilge i Ros Cré. ibid. 215-219

Father Paul O'Brien's Irish manuscripts - a note. ibid. 220.

Amhrán a bhaineann le cogadh na nDeachtaithe. Journal of Cork Historical and Archaeology Society, 83. 66-70.

Malachy McKenna

The Breton of Guéméné-sur-Scorff Part II: Morphology of the Verb.

Zeitschrift für Celtische Philologie 36. 1-49.

M Katharine Simms

The O Hanlons, the O Neills and the Anglo-Normans in 13th century Armagh.

Seanchas Ardmhacha ix. 70-94.

Liam Ó Murchú

Dearbhaíthe Ó Chontae an Chláir. Éigse xvii. 237-64.

Kim R McCone

The Dative Singular of Old Irish Consonant Stems. Ériu xxix. 26-38.

Cecile O'Rahilly

The Substantive Verb with Participle. Éigse xvii. 265.

9 MANUSCRIPT CATALOGUING

Cataloguing of the Irish manuscripts in the National Library of Ireland reached G 234. Rev Professor P Ó Fiannachta completed his work on the Irish manuscripts in diocesan libraries and other minor collections. Arrangements were made for the publication by Cambridge University Library of the Catalogue of Irish manuscripts in Cambridge which was compiled by Dr P de Brún and Miss M Herbert.

III - Annual Report of the Governing Board of the School of Theoretical Physics for the year 1978 adopted at its Meeting on 11 May 1979.

1 STAFF AND SCHOLARS

Emeritus Professor

John L Synge

Senior Professors

John T Lewis, Director from 1 January 1975; Rev James R McConnell; Lochlainn S O'Riadaigh.

Visiting Scientists

JP Antoine, 4-7 June; JH Calderwood, 21-28 February;
GW Chantry, 10-12 May; GW Ford, 31 July - 8 September;
D Frood, 8 May - 19 July; L Michel, 10-20 April;
JD Murray, 16-20 April; HB Nielsen, 4-11 June; J Nilsson,
20-26 November; HR Petry, 21 November - 6 December;
M Scheunert, continued from previous years to 30 November;
A Trautman, 4-22 April; J Wess, 23 June - 27 July;
GR Wilkinson, 6-10 December.

Assistant Professor

JH Rawnsley to 30 September.

Research Associates

S Dineen, PA Hogan, DJ Judge, Rev JD McCrea, W Sullivan (UCD);
PS Florides, BKP Scaife (TCD); Rev J Spelman, DH Tchrakian,
M Tuile (Maynooth); JM Golden (Foras Forbartha); AI Solomon
(Open University); T Garavaglia (Kevin St College of Technology);
MJ Conneely, MJ Newell (UCG); JR Saraf (NUU); all
appointments to 31 December 1978.

Scholars

W Mecklenburg, D O'Brien, MF Fry, NS Baaklini, to 30 September;
G O'Brien; Y Fujimoto, A Fordy, P Houston, D Pottinger, from
1 October; LA de Moraes from 1 November.

Research Student without stipend

B Goldsmith (Kevin St College of Technology).

Librarian-Executive

ER Wills.

2 GENERAL

A display of publications by members of the school, photographs,

and other items of interest, was organized in connection with the visit of the Minister for Education to the Institute on 25 April.

Two senior undergraduate students (one from TCD and one from UCD) were employed in the School during the summer months to assist with calculations in connection with research being carried out by Professors Ford, Lewis and McConnell, and with the compilation of an extensive bibliography (Professor O'Riadaigh).

3 RESEARCH AND STUDY

In collaboration with Professor Lewis, Professor Synge has been investigating the propagation of disturbances in a medium for which the speed of propagation depends on position, taking as a simple model the transverse vibrations of a string for which the linear density is not constant. The main results so far obtained are as follows. First, when the disturbance is suitably represented by a moving point in a real Hilbert space, the representative point describes a spherical helix. Second, at any instant the disturbance can be broken down into a part which is moving forward and a part that is moving backward; if it happens at a certain instant that there is no backward-moving part, such a part (a reflection) is immediately generated by the heterogeneity of the string.

Professor Lewis continued his work on statistical mechanics. He collaborated with Professor Ford (Ann Arbor) on developing averaging techniques for investigating the approach to equilibrium in quantum statistical mechanics. He collaborated with Professor Winnick (Groningen) on a study of C^* -algebra states associated with the Ising phase-transition.

Professor McConnell prepared material for publication of a book on the theory of rotational Brownian motion and its implications for the theory of dielectrics. In collaboration with Professor BKP Scaife he studied the influence of dipole-dipole interactions in dielectric phenomena. He cooperated with Professor JH Calderwood (Salford), Dr GW Chantry (National Physical Laboratory, Teddington) and Professor GR Wilkinson (King's College, London) in planning experiments designed to test the implications of theoretical research performed in the School on Brownian motion.

During the first part of 1978 Professor O'Riadaigh was primarily engaged in completing the review article on hidden gauge symmetry for Reports on Progress in Physics mentioned in the previous report. He also completed a shorter review on the same topic, which he delivered as a course of lectures at the Swiss National Institute for Nuclear Research; this review was published by that Institute. Later he worked on some problems on the algebraic structure of unified gauge theory which arose out of these two reviews. In the Fall Semester at Syracuse University he collaborated with

mechanical effects in large molecular systems; he developed numerical programmes with a view to interpreting the equations associated with such systems. Additionally, he brought to the final stages a large work on the effects associated with polarized electron (muon) scattering from polarized spin $1/2$ targets.

Dr Tchrakian investigated the possibility of constructing a supergravity theory where gravity interacts with a spin- $5/2$ particle; he began work on a programme which sought to unify as far as possible the investigation of instanton and monopole type self-dual solutions of the Yang-Mills field equation, on N -dimensional manifolds. He also made a study of the phenomenon that causes isospin degrees of freedom to give rise to spin degrees of freedom in a gauge theory, as well as a preliminary study towards vacuum tunnelling in instanton physics.

Dr Golden worked on anisotropic viscoelastic contact problems and modelling effects arising in unsaturated flow through porous media.

Dr Fry worked on functional integral methods for estimating the growth of large orders of perturbation expansions in quantum field theories.

Dr Mecklenburg continued his study of high dimensional theories, partly in collaboration with Dr D O'Brien.

Dr D O'Brien worked on non-Abelian gauge theories, and on instantons. He collaborated with Dr Baaklini in work on scalar field solutions to Yang-Mills and Vierbein field theories.

Dr Baaklini worked on Minkowskian instantons, on quantum gravity and supergravity, on space-time singularities and on quantization methods, the latter partly in collaboration with Dr Tuite. In this collaboration Drs Baaklini and Tuite applied Dirac's quantization method to constrained Hamiltonian systems.

Dr Tuite also worked on an 'axiomatic' (model-independent) approach to gauge theories, and on the problem of whether Yang-Mills gauge theory is of Einstein type, that is, whether the field equations imply the equations of motion. He collaborated with Dr Pottinger in a calculation of the fermionic effective potential for $1+1$ dimensional scalar as well as for spinor electrodynamics.

Dr Fujimoto worked on the gauge ambiguity in general relativity, 'weak colour', and the generalized K-M C-P violation matrix, and began a study of spontaneous symmetry breaking.

Mr Houston studied topics of nuclear form factors and operator product expansions.

Dr Fordy worked in the field of non-linear partial differential equations, with particular emphasis on those equations with multi-soliton solutions. He studied certain geometric techniques used to construct the associated (linear) scattering problem and Bäcklund transformation (when each exists) for a given partial differential equation. With Dr R Dodd (TCD) he has been investigating the use of symmetry groups to systematize some or all of the *ad hoc* steps used in the current method of construction for this problem.

Dr de Moraes studied holomorphic functions on strict inductive limits, in particular Fréchet Montel spaces, and reflexive Fréchet spaces; she obtained some interesting examples in the theory of infinite dimensional holomorphy.

Mr Goldsmith continued to work on the Kaplansky Test Problems for modules over a complete discrete valuation ring. He worked also in Specker groups, an area where there has been renewed interest since the discovery of an error in a standard proof.

4 SEMINARS AND REVIEW LECTURES

Review and seminar lectures were held throughout the year, and as in previous years they were attended by members of staff and students from Trinity College, Dublin, University College, Dublin, and St Patrick's College, Maynooth, as well as by members of the School of Cosmic Physics.

The following lectures were given

Prof JP ANTOINE (Univ Cath Louvain)	Indefinite metric and Poincaré covariance in quantum field theory.
Dr GW CHANTRY (NPL, Teddington)	Sub-millimetre waves: their application to science and technology.
Dr R DODD (TCD)	The prolongation structure of a higher order Korteweg-de Vries equation.
Prof E HARPER (George Washington Univ)	3-body scattering of quarks
Prof T KIANG (DIAS)	Stability of resonant orbits: A solution of a long standing problem in astronomy.
Prof L MICHEL (IHES, Bures-sur-Yvette)	Broken symmetry.

Dr JD MURRAY (Math Inst, Oxford)	Non-Linear differential equations with applications in chemistry and biology.
Prof HB NIELSEN (NBI, Copenhagen)	Is Lorentz invariance really necessary in fundamental theories?
Dr G PARISI (ENS, Paris)	Large orders of perturbation theory in 4 demensions.
Dr HR PETRY (Bonn)	Physical and mathematical aspects of Dirac monopoles.
Prof A TRAUTMAN (Warsaw)	Mass, spin and gravitation. Geometry of magnetic poles and simple instantons.
Prof J WESS (Karlsruhe)	Introduction to supergravity (2 Lectures)
Prof GR WILKINSON (King's Coll London)	Dielectric parameters of condensed phases.

At Meetings of the Relativity Group (Dublin) seminars were given at DIAS by:

Miss M IMAEDA	On the extraction of energy from a rotating black hole.
Dr JD McCREA (UCD & DIAS)	Algebraic computing in general relativity.
Dr G O'BRIEN (DIAS)	Conservation losses in general relativity.
Dr P HOGAN (UCD & DIAS)	Some Robinson-Trautman solutions of the Einstein-Maxwell equation.

Lectures in the TCD-UCD series on analysis were given at DIAS as follows:

First series:

WG SULLIVAN (UCD & DIAS)	Tensor products polynomials and representation theory. Introduction to tensor products and polynomials.
--------------------------	--

R RYAN (UCD)	Duality theory and polynomials.
P BOLAND (UCD)	Polynomials on nuclear spaces.
S DINEEN (UCD)	Some examples of nuclear sequences in infinite dimensional holomorphy.
Second series	
R ARON (TCD)	A problem of Shilov (2 lectures).
LA de MORAES (DIAS)	Recent results on holomorphic functions on locally convex spaces.
P BOLAND (UCD)	Power series spaces (results of E Dubinsky).
E DUBINSKY (Potsdam, USA)	Geometry of nuclear sequences.

Contributions to the Journals' Club (Particle Group, joint meeting of workers in this field from Maynooth, TCD, UCD, and DIAS) were given by:

D TCHRAKIAN	Monopoles and instantons.
Y FUJIMOTO	The Gribov ambiguity.
D O'BRIEN and M TUIITE	Merons (2).
M FRY	Asymptotic estimates.

5 COURSES

The Course on Statistical Mechanics of Infinite Systems begun during the previous year was continued: Dr WG SULLIVAN (UCD & DIAS) gave three lectures on 'Stochastic integrals', and Prof JT LEWIS (DIAS) gave two on 'Slow diffusion follows classical paths (after Truman)'.

The series of lectures suitable for final year undergraduates, and beginning graduate students, in Mathematics and Mathematical Physics, on Statistical Mechanics, begun the previous autumn, was continued by Professor LEWIS on through June.

6 STATUTORY PUBLIC LECTURE

A Statutory Public Lecture under the auspices of the School was delivered by Prof A TRAUTMAN (Warsaw) on 21 April, in Trinity College Dublin; the title of the lecture was 'Elementary general relativity'.

7 SYMPOSIA

Two Mathematical Symposia were held during the year, 22-23 March, and 20-21 December. The attendances (41 in March, 46 in December) included professors, lecturers and graduate students from the several Irish universities, the Colleges of Technology, and other Irish institutes and colleges.

For the December Meeting a new scheme was devised; there were three Sections, namely, Review, Applied Mathematics, and Pure Mathematics; the latter two sections were parallel.

In addition to the short communications (previews), the following lectures were delivered:

MARCH

Prof J DIESTEL (UCD)	The fundamental theorem of integral calculus.
Dr T MURPHY (TCD)	The Fermi calculus.
Dr GV KELLY (UCC)	Natural elements for harmonic and biharmonic boundary-value problems.
Dr MP MORTELL (UCC)	Finite oscillations in closed tubes.
Dr P MCGILL (NUU)	Group-valued measure extensions and decompositions.
Dr F HOLLAND (UCC)	On Kahane's example of a smooth singular function.

DECEMBER

Review

Dr T LAFHEY (UCD)	Sub-algebras of matrix algebras.
Dr R BATES (Met/Service)	Influence of cooling to space on the dynamics of planetary waves in the stratosphere.

Prof ML NEWELL (UCG)	On certain groups having a fourth-power endomorphism.
Prof D McQUILLAN (UCD)	Remarks on the Hilbert Nullstellensatz.
Applied Mathematics	
Dr N O MURCHADHA (UCC)	All asymptotically flat solutions of Einstein's equations are linearization stable.
Prof JJ MILLER (TCD)	On uniformly convergent finite difference schemes for singular perturbation problems.
Pure Mathematics	
Dr T HURLEY (UCD)	A collection process.
Prof AG O'FARRELL (Maynooth)	Point derivations on a space of Lipschitz functions.

8 VISITORS

For lectures given by visitors, see §§4,6.

- 0/0 Prof JP Antoine (Cath_L Univ_L Louvain) 4-7 June;
 Prof JH Calderwood (Salford) 21-28 February;
- 6/0/0 Dr GW Chantry (Nat_L Phys_L Lab_L, Teddington) 10-12 May;
 0/0 Dr J Chela-Flores (Univ_L S_L Bolivar, Caracas) 20-21 December;
 0/0 Prof E Dubinsky (Clarkson Coll_L Tech_L Potsdam, USA) 11 December;
- Prof GW Ford (Ann Arbor, Mich) 31 July - 8 September.
 Prof D Frood (Lakehead, Ont) 8 May - 19 July;
- 0 Prof E Harper (George Washington Univ_L DC) 11 August;
 Prof L Michel (IHES, Bures-sur-Yvette) 10-20 April;
 Dr JD Murray (Math Inst Oxford) 16-20 April;
 Prof NB Nielsen (Niels Bohr Inst, Copenhagen) 4-11 June;
 Prof J Nilsson (Göteborg) 20-26 November;
 Dr G Parisi (Ecole Norm Sup, Paris) 2 May;

Dr HR Petry (Bonn) 21 November - 6 December;

Prof JM Pollin (US Army, West Point) 20-21 December;

Dr M Scheunert (Bonn) continuing from previous years to
30 November;

Dr G Smith (Brookhaven Nat Lab) 11 August;

Prof A Trautman (Warsaw) 4-22 April;

Prof J Wess (Karlsruhe) 23 June - 27 July;

Prof GR Wilkinson (King's Coll, London) 6-10 December.

9 EXTERNAL ACTIVITIES

Professors Synge, Lewis and O'Raifeartaigh, and all the School's Scholars and visitors then present attended the Meeting for Discussion 'Geometric Aspects of Theoretical Physics' organized jointly for the Royal Irish Academy and the Royal Society by Prof MF Atiyah, FRS (Oxford) and Prof Lewis, 22-24 November. A discourse 'Geometry and Physics' was given by Prof Synge, and lectures were given by Prof O'Raifeartaigh on 'The renaissance of geometry in physics' and Prof Lewis on 'Ising-type phase transitions and the index of states of the Clifford algebra'.

Professor Lewis attended a Conference on Mathematical Problems in the Theory of Irreversible Processes, at Arco Felice, Naples, from 12 to 19 March, where he gave a course of three lectures; and a meeting of the Irish Mechanics Group at University College, Cork, 12-13 May. He was an Invited Speaker at the London Mathematical Society Research Symposium at Durham on Mathematical Theory on Non-linear Problems in Quantum Mechanics and Quantum Optics, 3 to 15 July. From 1 September to 15 November he visited the Institute of Theoretical Physics in the University of Groningen.

Professor O'Raifeartaigh completed his one-month visit, begun the previous December, to the Institut des Hautes Études, Bures-sur-Yvette; he gave a colloquium there on Unified Gauge Theory. He gave a series of four talks on Solitons at a Workshop at Lausanne, organized by the Swiss-Romand Universities, 12-18 March; attended the Easter-School of Karlsruhe University, 18-29 March, and gave an Invited Talk there on the Structure of the Weak Current; and then gave a course of four lectures on Weak Interactions and Gauge Theories at the Spring School of the Swiss National Institute for Nuclear Research (Zuoz), 29 March to 8 April. He attended a Meeting on Mathematical Problems in Feynman Path Integrals, 22-26 May, at the University of Marseille, and gave an Invited Talk there on Effective Potentials. In June

he gave seminars at the Universities of Karlsruhe, Zürich, and Berne; and attended a Symposium on Mathematical Methods in the Theory of Elementary Particles, 18-23 June, in Liblice (Prague), where he gave an Invited Talk on The Structure of the Weak Current. With Dr Scheunert he attended the Integrative Conference on Group theory and Mathematical Physics, 9-16 September, at Austin, Texas: Professor O'Raifeartaigh was Organizer and Chairman for the Session on Gauge Groups and Solitons; Dr Scheunert gave a lecture on Generalized Lie Algebras. Professor O'Raifeartaigh was a Visiting Professor at Syracuse University for the Fall Semester, and gave a Graduate Course there on Supergravity; he also gave seminars at Massachusetts Institute of Technology, Brookhaven National Laboratory, Cornell University, Brown University, Rockefeller University, Indiana State University, Michigan State University, and Université de Montreal; and colloquia at the Universities of Syracuse, Texas, and Notre Dame, during this visit to Syracuse.

On 28 June Professor O'Raifeartaigh spoke on the RTE programme 'Discovery', on the value to the community of research and development.

Dr Schuenert attended a Seminar on Topological Methods in Quantum Field Theory and Particle Physics, 8-12 November, at Bonn.

Professor McConnell lectured to the Mathematical Society at University College, Cork, on 17 January. He attended the meeting of the Dielectrics Society, 4-6 April, at Oxford; and visited the University of Salford, 6-21 July, and gave a seminar at Brown University on 20 July. He attended the Gordon Conference at Plymouth, New Hampshire, 24-28 July.

604p K-23B

Dr Rawnsley attended a Meeting on Field Theory, at the Niels Bohr Institute, Copenhagen, 23-25 January; he attended a Meeting on Algebraic Vector Bundles on Projective Spaces, at the Mathematical Institute, Oxford, 15-19 May; he attended the Canadian Mathematical Congress, seminar on Global Analysis, at the University of Calgary, 12-27 June, and gave a seminar there on Flat Partial Connections; he visited CNRS, Marseille, 19-26 February, and gave a seminar on Cohomology Groups of Polarizations; and he visited the University of Kaiserslautern from 5-7 June, and gave a seminar there on Construction of Self-dual Yang-Mills Fields.

Dr Golden attended a Conference on consecutive Equations and Methods of Solution in Viscoelasticity, at Smolenice, Czechoslovakia, 29 May to 1 June, where he gave a talk on Inertial Viscoelastic Contact Problems.

Professor Florides gave a talk to the Astronomical Science Group of Ireland on 22 November, on the Robertson-Walker Metrics Reducible to Static Form.

Dr McCrea and Dr G O'Brien attended the Ninth Texas Symposium on Relativistic Astrophysics, at Munich, 14-19 December.

Dr Hogan attended a Meeting on Black Holes, on 20 March, at Oxford.

Dr Tchraikian continued his visit to Imperial College, London, under the Royal Irish Academy / Royal Society Exchange Programme, and then went to Kaiserslautern University as an Alexander von Humboldt Fellow, during the first nine months of the year. He gave seminars at Imperial College, Westfield College (London), Kaiserslautern, Karlsruhe, Clausthal-Zellerfeld, Gothenburg, and Marseille, and he attended the CNRS Rencontres at Strasbourg in June.

Drs Tuite and Fry attended the Rutherford High Energy Laboratory Meeting 4-6 January, and Dr Tchraikian and Mr Houston attended the next Meeting in this series, 19-21 December.

Dr Fry gave a seminar at the University of Groningen on 3 April, on Spoor of a Fixed Point.

10 PUBLICATIONS

Notes 1 *Items marked with an asterisk were recorded as in press in previous reports.*

2 *Because of the postal difficulties early in 1979 it has not been possible to collect all the references which properly should be inserted in this Report; some publications which appeared during 1978 are therefore not listed here, but it is hoped will be listed in the next Report.*

(1) Books

Published

JL Synge and A Schild. Tensor calculus. Republication by Dover Publications, New York, 1978.

(2) Communications of the Dublin Institute for Advanced Studies, Ser A (Theoretical Physics):

Published

No 25 Differential geometry of instantons.
By JH Rawnsley. Price £3 15 pp v+60. Published
1 November, 1978.

In the press

No 26 Differential forms in general relativity.
 By W Israel. Second edition.

(3) Contributions to periodicals and other publications

Published

C Lanczos

- * Symmetry and the principles of geometry. Symmetry, Similarity and Group Theoretic Methods in Mechanics, ed PG Glockner & MC Singh, Proc Sym Univ Calgary 1974 (dedicated to C Lanczos). Amer Acad Mech / Univ Calgary 1974 (?), pp 3-21.

JR McConnell

- * Correlation functions for spherical harmonics resulting from rotational Brownian motion of a linear molecule. Proc RIA 78A (1978), 87-97.

GW Ford, JT Lewis & JR McConnell

- * Correlation times and complex permittivity for linear and spherical top molecules. Physica 92A (1978), 630-633.
- * The rotational Brownian motion of an asymmetric body. Proc 13th IUPAP Conf Statist Phys, Haifa, 1977, Ed C Weil Hilger 1978. Pt 2, 726-729.

L O'Riifeartaigh

- * Static solitons in more than one dimension. Proc Conf on Mathematical Problems in Theoretical Physics, Rome, 1977, ed G Dell'Antonio et al Springer 1978 (LNP 80), pp 205-215.

K * Static solitons in more than one dimension. Proc Conf on Group Theoretical Methods in Physics, Tübingen, 1977, ed P Kramer & A Riechers. Springer 1978 (LNP 79), pp 345-356.

- * Finite energy solutions of gauge theories. III Sch Elem Parts and HE Physics, Primorsko (Bulgaria), 1977. Sofia, Inst Nucl Res & Nucl Ener, 1978, pp 95-129.

- * Classical static gauge-field solitons in three space dimensions. Many Degrees of Freedom in Field Theory, Bielefeld 1976, ed L Streit. Plenum (NATO ASI Ser B (Phys) v 30) 1978, pp 117-145.

L O'Riifeartaigh & JH Rawnsley

- * Mass-spectrum for monopoles of integral isospin bag-model

as the high isopin limit. Phys Lett 72B (1978), 465-470.

JH Rawnsley

* On the pairing of polarizaitons. Commun Math Phys 58 (1978), 1-8.

PA Hogan & G O'Brien

Some Robinson-Trautman solutions of the Einstein-Maxwell equations. Phys Lett 67A (1978), 335-336.

AI Solomon & W Montgomery

* Generalised XY model. J Phys 11A (1978), 1633-1644.

T Garavaglia

Null-plane approach to nonlinear interations between electromagnetic quantum fields: Forward photon-photon scattering, regularization, and Delbrück scattering. Phys Rev 12D (1975), 3327-3340.

V Rittenberg & M Scheunert

* Elementary construction of graded Lie algebras. J Math Phys 19 (1978), 709-713.

MP Fry

2 papers combined
* Multipseudoparticles and perturbation theory in large order for the scalar Yukawa₂ field theory. Phys Lett 80B (1978), 65-67.

NS Baaklini

* Non-linear de Sitter symmetry and restricted propagation universes. Nuovo Cim Lett 22 (1978), 219-222.

* Quantization around superparametrised finite-energy classical solutions. J Phys 11A (1978), 2083-2091.

Quantization of superparametrized monopoles. Nuclear Phys 142B (1978), 510-524.

Quantum spinors and the singularity theorems of general relativity. Phys Lett 66A (1978), 357-358.

Minkowskian instantons. J Phys 11A (1978), L127-L128.

NS Baaklini & M Tuite

Dirac quantization of massive spin-3/2 field. J Phys 11A (1978), L139-L142.

NS Baaklini & D O'Brien

Scalar field solutions to Yang-Mills and Vierbein field theories. LMP 2 (1978), 287-290.

DP O'Brien

Lagrangian formalism for the theory of spin-3 fields. Phys Rev 18D (1978), 4548-4550.

W Mecklenburg & D O'Brien

* Factorized gauge solitons in n dimensions. Phys Rev 18D (1978) 4679-4683.

* Time-dependent property of the Prasad-Sommerfield monopole. Phys Rev 18D (1978), 1327-1328.

W Mecklenburg

Mass splitting in high dimensional extensions of general relativity. Acta Phys Polon 9B (1978), 793-798.

B Goldsmith

* A topological approach to a problem of Nunke. Arch d Math 30 (1978), 271-274.

* Essentially-rigid families of abelian p-groups. J Lond Math Soc (2) 18 (1978), 70-74.

WT Coffey & BV Paranjape

* Dielectric and Kerr effect relaxation in alternating electric fields. Proc RIA 78A (1978), 17-25.

In the press

JL Synge

My relativistic milestones. Einstein Centenary Volume, edited by GE Tauber, Tel-Aviv University.

GW Ford, JT Lewis and JR McConnell

Rotational Brownian motion of an asymmetric top. Phys Rev A.

L O'Raiheartaigh

Hidden gauge symmetry. Rep Progr Phys.

Axiomatic, or model-independent, approach to the symmetries of the elementary particles. Proc Sym on Mathematical Methods in the Theory of Elementary Particles, Liblice, Czechoslovakia, 1978.

X
Continued
to Part A
Phys. Analysis

Gauge theories with hidden symmetry. Proc 1978 Spring School on Weak Interactions and Gauge Theories, Swiss Inst Nuclear Research, SIN Documentation Group.

L O'Riada & G Parravicini

Anomalous behaviour of the effective potential. Proc Colloquium on Mathematical Problems in Feynman path integrals, Marseille, 1978.

M Scheunert

Generalized Lie algebras. J Math Phys.

An introduction to the theory of Lie superalgebras. Springer, Lecture Notes in Mathematics.

JH Rawnsley

Some Properties of half-forms. Proc Conf on Differential Geometrical Methods in Mathematical Physics, Bonn, 1977.

PA Hogan and M Imaeda

Equations of motion in linearized gravity uniform acceleration. J Phys A.

Equations of motion in linearized gravity: Run-away sources. J Phys A.

On the motion of sources of some Robinson-Trautman fields. J Phys A.

JD McCrea and G O'Brien

Spin precession in the relativistic two-body problem. Gen Rel Grav.

Synge's equations of motion applied to a perfect fluid. J Phys A.

G O'Brien

Orbital equations in the relativistic two-body problem. Gen Rel Grav.

DH Tchraikian

On the possibility of spin-5/2 supergravity. Nuovo Cim Lett.

W Mecklenburg & DP O'Brien

Gauge field masses and degenerate potentials. Nuovo Cim Lett.

NS Baaklini

SL (2,C) exterior forms and quantum gravity. Phys Rev D.

nut (~~Quantization of superparametrized monopoles. Nuclear Phys B.~~
~~Quantization around superparametrized finite-energy classical solutions. J Phys A.~~)

(4) Research Reports

Research work during the year was written up in the first instance as research reports. Two lists of titles of these reports (preprints) were circulated to approximately 160 research institutes and university departments of mathematics and physics, at their request, throughout the world; as far as available copies of these preprints were supplied, on request, to research workers in these institutes and departments.

DIAS-STP-78-01: JH Rawnsley: A non-unitary B-K-S pairing of polarizations.

-02: NS Baaklini: Minkowskian instantons.

-03: JH Rawnsley: Some properties of half-forms.

-04: JH Rawnsley: Flat partial connections and holomorphic structures in vector bundles.

-05: NS Baaklini & DP O'Brien: Scalar field solutions to Yang-Mills and Vierbein field theories.

-06: P Hogan & M Imaeda: On the extraction of energy from a rotating black hole.

-07: W Mecklenburg: Curved superspaces and the supersymmetry problem.

-08: NS Baaklini: SL (2,C) exterior forms and quantum gravity.

-09: W Mecklenburg: Mass splitting in high dimensional extensions of general relativity.

- 10: L O'Raifeartaigh: Classical static gauge-field solitons in 3 space dimensions.
- 11: DP O'Brien: A Lagrangian formalism for the theory of spin 3 fields.
- 12: DP O'Brien: A Lagrangian formalism for pseudo-vector and pseudoscalar fields.
- 13: NS Baaklini: Quantum spinors and the singularity theorems of general relativity.
- 14: M Tuite: Definition and calculation of the effective potential.
- 15: NS Baaklini: Confining solution in Yang-Mills theory of a de Sitter gauge group.
- 16: L O'Raifeartaigh: Hidden Gauge symmetry.
- 17: M Tuite: Derivation of the effective potential for quantum electrodynamics.
- 18: JD McCrea & G O'Brien: Spin precession in the relativistic two-body problem.
- 19: G O'Brien: Orbital equations in the relativistic two-body problem.
- 20: M Tuite: The effective potential for fermions in quantum electrodynamics.
- 21: NS Baaklini: Is supergravity the fundamental super-geometric theory of the hadron?
- 22: M Tuite & NS Baaklini: Dirac quantization of massive spin 3/2 field.
- 23: JD McCrea & G O'Brien: Synge's equations of motion applied to a perfect fluid.
- 24: PA Hogan & G O'Brien: Some Robinson-Trautman solutions of the Einstein-Maxwell equations.
- 25: L O'Raifeartaigh: Gauge theories with hidden symmetry.
- 26: NS Baaklini: Quantization around superparametrized finite-energy classical solutions.
- 27: NS Baaklini: Quantization of superparametrized monopoles.

- ~ -28: NS Baaklini: Generalized ground state of quantum field theory.
- 29: MP Fry: Vacuum energy density in large orders of perturbation theory for the scalar Yukawa₂ field theory.
- 30: L O'Raifeartaigh: Axiomatic, or model-independent, approach to the symmetries of the elementary particles.
- 31: W Mecklenburg & D O'Brien: Gauge field masses and degenerate potentials.
- 32: JH Rawnsley: On the Atiyah-Hitchin-Drinfeld-Manin vanishing theorem for cohomology groups of instanton bundles.
- lc -34: L O'Raifeartaigh: Hidden Gauge symmetry.
- 35: L O'Raifeartaigh & G Parravicini: Anomalous behaviour of the effective potential.
- 36: M Scheunert: Generalized Lie algebras.
- 37: NS Baaklini: Supergravity and space-time singularities.
- 38: JH Rawnsley: Self-dual Yang Mills fields.
- 39: JH Rawnsley: Differential geometry of instantons.
- 40: NS Baaklini & M Tuite: Dirac quantization of spin 2 fields.
- 41: R Flood & W Sullivan: Consistency of random field specifications.
- 42: PA Hogan & M Imaeda: Equations of motion in linearized gravity uniform acceleration.
- 43: PA Hogan & M Imaeda: Equations of motion in linearized gravity: run-away sources.
- 44: PA Hogan & M Imaeda: On the motion of sources of some Robinson-Trautman fields.
- 46: DH Tchrakian: On the possibility of spin-5/2 supergravity.
- 47: DH Tchrakian: N-dimensional instantons and monopoles.
- 48: DH Tchrakian: The magnetic charge of a spherically symmetric class of SU (2) monopoles.

11 LIBRARY

Approximately 160 new titles were added to the library stock during the year; approximately 200 current periodicals were taken, of which almost half were received by gift or under exchange arrangements. The holdings of subscription periodicals were regularly scrutinized with regard to greatest needs, cost and availability elsewhere in Dublin; a small number of subscriptions was dropped, and a small number of essential new subscriptions taken up. Contact with the Library of the RIA, the Dept of Mathematics and Mathematical Physics at UCD, and the Faculty of Science at Maynooth College was maintained. The RIA 'permanent loan' scheme got under way, and runs of 18 series 'on permanent loan' from the RIA are now shelved in the Library.

As well as journals received regularly under exchange arrangements, gifts of books and journals were received during the year. Donors included Profs Synge, McConnell, O'Riifeartaigh and Lewis, Drs Tchrakian and Baaklini, the Dept of Agriculture, NBST, Bell Telephone Laboratories, University of Bristol, DESY, University of Geneva, ICTP (Trieste), Inst Nucl Res & Nucl En (Sofia), KEK (Japan), Kazakh Inst of Sciences (Alma-Ata), Mathematisch Centrum (Amsterdam), Physical Society of Japan, Royal Swedish Academy of Sciences, Drs G Giorentini & G Torelli (E Majorana Centre, Erice), Dr L Castell, Prof A Trautman, and Dr P Yodzis. Preprints were received from scientific institutes and university departments all over the world, either directly or in response to requests.

A party of Librarians and information workers from the University and Special Libraries Section of the Library Association of Ireland visited the School on 15 March, and were shown the Library; a collection of mathematical and physical works by Irish authors, especially of the nineteenth century, and by members (past and present) of the School, together with photographs and other items of interest, was on display during this visit.

IV - Annual Report of the Governing Board of the School of Cosmic Physics for the year ended 31 December 1978 adopted at its meeting on 28 April, 1979.

A ASTRONOMY SECTION

1 STAFF AND SCHOLARS

Senior Professor

PA Wayman

Professor

T Kiang

Research Assistant

I Elliott

Experimental Officer

BD Jordan

Research Associate

CJ Butler (Armagh Observatory)

Technical and Clerical Staff

Miss AM Callanan; WM Dumbleton; RP Murphy.

Scholars

CM Sharp; M Gossler (to 31 March 1978); PP Murphy (from 1 October 1978).

Professor Wayman continued as Assistant General Secretary of the International Astronomical Union throughout the year; also as Chairman of the National Committee for Astronomy, a Council member and Vice-President of the Royal Irish Academy and a member of the Library and Space Research committees of the Academy.

Dr Elliott continued as Secretary of the National Committee for Astronomy, as an Associate Editor of the Irish Astronomical Journal, and as Observer for Ireland in the Joint Organisation for Solar Observations.

2 RESEARCH WORK

Cepheid Photometry: PA Wayman and CJ Butler

The relationship between measured positions on UK Schmidt photographs of the Cepheid regions LMC I and LMC LL and catalogue positions was evaluated to 0.2 arc-second precision and a search procedure for 22 Schmidt plates on Galaxy machine at the Royal Greenwich Observatory was established. One trial measurement of 1,155 stars showed that serious problems may occur as regards photometric accuracy of these plates, contrary to expectation, but the delineation of period changes should nevertheless be possible.

Solar Research: I Elliott

H α chromospheric data have been transferred from magnetic tape to Eclipse disk. A program was written to eliminate all known errors and preparations have been made for displaying the data by means of a graphics terminal.

Dynamical Astronomy: T Kiang

Work has been concentrated on a new approach to the problem of stability of asteroid orbits which are resonant with the period of Jupiter's orbit. This is the problem of the Kirkwood gaps which were noticed empirically a century ago and, though the instability is understood in general as due to resonant perturbations, there was never a full appreciation as to why certain resonances, particularly the $3/2$ resonance, resulted in a concentration of asteroids, the so-called Hilda group.

An approach based on the idea of the existence of a 'hyperperiod' as a criterion of stability has been found to be successful. This requires the derivation, for a particular periodic situation, of a Hill's Equation governing the behaviour of an arbitrary small displacement. Identification is made with the canonical system of one degree of freedom obtained by Schubart in 1964 after averaging the Hamiltonian for the simplest gravitational model of a resonant asteroid. The novelty of the present approach is that variations of the Schubart elements are found to be governed by a Hill's equation, whose coefficients can be examined for existence of a hyperperiod and hence of stability. It is in this respect that the $3/2$ resonance (Hilda group) differs markedly from for example, the $2/1$ resonance (Hecuba gap).

This subject has been the topic of talks given during 1978 in Dublin, Glasgow, Tokyo, Peking, Nanking, Shanghai, Hefei and Hong Kong.

Stellar Atmospheres: CM Sharp

A start has been made on work in connection with the contribution of triatomic molecules to the Rosseland Mean Opacity in the atmospheres of late-type stars. Direct integration of the large number of spectrum lines is not feasible and the method entails breaking the spectrum into a large number of 'bins', obtaining an approximation for each bin. The Gaussian and Lorentzian profiles have been examined. Numerical experiments have been constructed to check reliability of the method.

Historical Astronomy

PA Wayman : A review was made of the material concerning the Dublin telescope firm of Grubb (c 1855 - 1925) and a small exhibition mounted in the premises of the Royal Irish Academy.

I Elliott : Following discussion in current journals concerning the Star of Bethlehem, examination of Tuckerman's tables of planetary positions revealed the remarkable degree of symmetry of the stationary points for Saturn and Jupiter in 6 BC. The triple conjunction of that year is therefore strengthened as the likely astrological explanation of the tradition.

T Kiang : Although the Chinese calendar is unambiguous for five millenia, interpretation of some observations of Comet Halley appear to be uncertain because it is not known whether the day commenced at midnight or at dawn. Attempts to resolve this question by consulting two authorities have not been successful.

3 ELECTRONICS LABORATORY: BD Jordan

Design work and construction has commenced on a control unit for the Acquisition and Guidance box of the 2.5m telescope at La Palma (Isaac Newton Telescope). This project is part of the collaboration on instrumentation between the Section and the Instrument Development Department of the Royal Greenwich Observatory. The control unit governs the operation of TV camera and photoelectric guider in the focal plane of the telescope, and other auxiliary devices, by means of a Motorola 6800 microprocessor. The main microprocessor board has been completed and tested and work on the interface boards has commenced.

The Nova 2/10 minicomputer was installed in a temporary building early in the year. An Apple II microcomputer using an existing Prowest monitor for visual display, together with a dual diskette drive, was also installed. Interfaces with the Nova 2/10 were established and tested.

A solid-state video camera using a charge-coupled 100 x 100

Fairchild CCD 202C diode array was purchased and mounted in a test assembly.

4 COMPUTER INSTALLATION : I Elliott

A TTY 43 matrix printer was installed on the Nova 2/10 computer to replace the existing teletype. An Apple II microcomputer provides BASIC-language programming and interactive graphics with potential linking to the operation of the Nova 2/10. The display is 280 x 190 pixels on the standard TV-type monitor.

A Data General Eclipse S/130 computer with 10 Mbyte disk and 9-track magnetic tape unit was installed at 5 Merrion Square as a 'School' replacement for the Nova 2/10 installation. The system uses an ADDS 580 visual display unit and a Dasher matrix printer operating at 60 cps.

Attempts to establish a satisfactory data-link between the Nova and the Eclipse have been unsuccessful, due to telephone-line difficulties. A line from the Nova to the Kilmainham IBM 370 installation is still not in operation, awaiting satisfactory transfer of software.

Software projects include successful implementation of a version of FORTH, with assistance from St Andrews University, generation of the operating systems for the Eclipse installation, benchmark tests with the Eclipse, and transfer of data from the 2.5 Mbyte Nova disks to the Eclipse disk system, using the facilities of Medical Data Systems International.

5 CONFERENCES, LECTURES, ETC.

The 44th Meeting of the Executive Committee of the International Union was held in Dublin 18-19 August 1978. The Institute and the Royal Irish Academy were joint hosts at an evening reception and dinner on 17 August. Visitors to the Observatory at this time included Professor A Blaauw (Leiden), President of the Union; Vice-Presidents EK Kharadze (Abastumani), Ch Fehrenbach (Haute-Provence), J Bolton (Sydney), W Iwanowska (Torun), S van den Bergh (Victoria, BC) and D Heeschen (NRAO, Virginia); General Secretary EA Muller (Geneva) and former President L Goldberg. The correspondence on IAU Symposia, Colloquia and Regional Meetings (31 international meetings in 1978 and 1979) was handled by PA Wayman as Assistant General Secretary through the year.

The following Colloquia were held:

- | | |
|----------|--|
| 14 March | E Gahn (Stockholm) "Early Phases of Stellar Evolution" |
| 20 April | W Sherwood (MPI Bonn) "Diameters of OH/IR Sources" |
| 3 May | R Ellis (Durham) "Clustering of Galaxies" |

- 7 November T Hawarden (Edinburgh) "The UK Schmidt Program"
- 21 November SVM Clube (Edinburgh) "Cepheids and the distance scale"
- 30 November R Stapleton (St Andrews) "FORTH at St Andrews"

PA Wayman gave a series of eight lectures "Radiation and Stellar Structure" in the Physics Department, TCD, January-March 1978.

T Kiang presented two papers at IAU Symposium No 81 in Tokyo, 23-26 May, 1978;

"Long Propagation Periods of Residuals in the Motion of a Comet"

"Hyperperiods, Orbital Stability, and the Solution of the Problem of Kirkwood Gaps"

The same material was used by T Kiang as a basis for colloquia at the School of Theoretical Physics (3 May), The Irish Astronomical Science Group (22 November), The Peking Observatory and elsewhere in China, and at the University of Glasgow (28 November).

PA Wayman spoke on "The Dunsink Cepheid Programme" at the University of Manchester on 27 April.

PA Wayman, T Kiang, BD Jordan, I Elliott and C Sharp continued talks to the Dublin Centre of the Irish Astronomical Society during the year and also, with W Dumbleton, provided speakers at the usual fourteen Public Open Nights at Dunsink Observatory.

T Kiang spent 5 weeks in June and July in China, visiting astronomical institutes and university departments at Peking, Nanking, Shanghai and Hefei. This visit was partly supported by a financial grant from the Royal Irish Academy.

PA Wayman visited the University of the Orange Free State with Dr M de Groot, director of Armagh Observatory, 29 May - 14 June. They included visits to the South African Astronomical Observatory at Sutherland CP, and Cape Town.

I Elliott attended the JOSO Workshop on Future Solar Optical Observations in Florence, 7-10 September, and an On-Line Seminar on Interactive Computer Graphics in London 12-15 September. BD Jordan attended the ESO Symposium on CAMAC in Astronomy in September. PA Wayman attended meetings of the Royal Astronomical Society in London in January, May, October and November.

Visitors to Dunsink Observatory other than those mentioned above included HA Bruck, WH McCrea, JV Jelley, A Wolfendale, K Walter, L Mestel, and Dr Stephen Whittaker. Members of the International Union of Amateur Astronomers meeting in Dublin in August also visited the Observatory.

6 PUBLICATIONS

I Elliott continued as Assistant Editor of the Irish Astronomical Journal during 1978 and T Kiang continued with translation work for Pergamon Press for their journal "Chinese Astronomy".

Contributions from the Dunsink Observatory No 15 : HB Photometry of Northern Intermediate Galactic Latitude Early-Type Stars and Galactic Structure away from the Galactic Plane", by AE Lynas-Gray and PW Hill (in press, R Astr Soc).

Contributions from the Dunsink Observatory No 16 : "Photometry of Cepheids in the Large Magellanic Cloud", by CJ Butler, Astronomy and Astrophysics Supplement, 32, pp 83-126, 1978.

T Kiang :

"Kirkwood Gaps and stability of conservative periodic systems", Nature 273, pp 734-736, 1978.

"Reply to Aoki's Comment", Nature 275, p 568, 1978.

"Nature : Chinese Style", Nature 275, p 697, 1978.

I Elliott :

"The Star of Bethlehem", Quarterly Journ R Astr Soc, 19, pp 515-516, 1978.

PA Wayman

"A Note on Fitting Procedures for Stellar Positions on Schmidt Photographs", Irish Astronomical Journal (in press)

Book Reviews : "The Historical Supernovae", Observatory Magazine.

"Lifecloud", Irish Times.

7 MISCELLANEOUS

Arrangements were made with the University of the Orange Free State concerning the removal of the Armagh-Dunsink-Harvard

telescope from the Boyden Observatory, Bloemfontein. The telescope was thoroughly inspected and labelled and lists for consignment were prepared. A statement defining ownership was agreed with the UOFS. The project for re-mounting the telescope in Baja California awaits financial support from the Mexican National Observatory.

Agreements concerning the operation of a 10% Irish share in a 1-metre reflecting telescope at the Spanish International Astrophysical Observatory on La Palma, Canary Is, have been prepared. Construction of the telescope and auxiliary equipment has begun and completion is scheduled for 1981

Following the fire at Dunsink Observatory in October 1977:-

Dunsink House has been re-wired to an adequate standard for occupation as offices.

The dome on the main building has been recovered.

Temporary accommodation for electronics laboratory and Nova computer has been provided.

A Temporary electricity supply in the main building was connected.

Damaged rooms of director's house have been redecorated.

Some damaged offices in the main building, ground floor, have been redecorated.

Library material for approximately 60% of the important destroyed volumes has been reinstated by gift and purchase.

Damaged textbooks have been cleaned and re-arranged.

Basement rooms have been vacated.

The main contract for re-building the Meridian Room and basement areas has commenced. The piers formerly used for the historic Ramsden Circle have been removed and erected on the south side of the Meridian Room.

The Nova computer has been fully restored and equipment purchased for the electronics laboratory.

Discussion has taken place at the Council concerning future housing policy for the Institute as a whole. An approach to the Department of Education has been made to erect a new building on the existing Institute site at 10 Burlington Road adequate for all the research sections of the Institute. It is therefore expected that day-to-day work of the Section will, in due course, be carried out in that location. It is proposed that Dunsink

Observatory shall maintain its historic aspect and shall continue under the auspices of the Institute. Functions of the Institute that can best be effected in a non-central location will be transferred permanently to the Dunsink site. These functions could include field work for astronomy and geophysics, distribution of Institute publications, provision of a centre for conferences, including teachers' courses, and provision of a centre for the study of the history of astronomy and mathematics.

The conditions of work for the Astronomy Section during 1978 were replete with difficulties that seriously impeded efficiency. Many of these difficulties had been present prior to the fire damage, and substantial changes were being considered. It is important that the transition from the current situation to a permanent provision of accommodation for the School be effected in a way which will promote the activity and efficiency of the work carried out by the Section. Unfortunately there is evidence of a static situation in the staff which is not commensurate with the rapid development of facilities available rather generally in astronomical science. The permanent academic staff of the Section has remained unchanged for twelve years, which is too long.

During 1978 the final break with the Boyden Observatory was effected. The use of facilities at the former Southern Station of Harvard College Observatory dates from the foundation of the Section in 1947. Successive Annual Reports describe the way in which these facilities have been used, often jointly with Armagh Observatory. Support from the United States ceased in 1976. The Boyden Observatory was operated through informal agreement among a number of institutions for twenty-one years (1955-76). In recent years it has proved impossible to attract sufficient funds to up-date the type of facilities available at Boyden Observatory, and other opportunities have arisen. The ADH telescope, in particular, always suffered by its being mounted on an inadequate and out-dated mounting. Removal and possible re-erection on a new mounting in Mexico was recommended to the Board and to the Board of Armagh Observatory but a formal agreement has not yet been arrived at with the Mexican authorities.

For the future, the South African facilities are, almost certainly, to be replaced by participation in the United Kingdom share of the proposed Spanish International Observatory of the Canary Islands. On La Palma, optical instruments for stellar and solar astronomy will be established by 1982. It is proposed that a Committee of the Board shall advise the Board on all matters in connection with this project from May 1979, interpreting their task on the basis of providing a National Facility. Representatives of the National Board of Science and Technology and the Royal Irish Academy National Committee for Astronomy will serve on this Advisory Committee. It should be emphasized that the UK Science Research Council has welcomed all the suggestions for Irish participation.

At the present time, the Section is contributing in a major way to international aspects of astronomy. The International Astronomical Union, which held its Ninth General Assembly in Dublin in 1955, has always been an organisation of considerable help to small countries, as well as providing a forum for those aspects of astronomy that require international agreement. PA Wayman has carried out the duties of Assistant General Secretary for the period 1979-82, when he assumes responsibility for all the affairs of the Union, acting as the link between the Executive Committee and the separate National Committees of all member countries, and with astronomers who are active in Union affairs.

Finally it is appropriate to remark that reciprocal interests with Armagh Observatory have been maintained in recent years and are likely to remain strong. Two former scholars of the Institute, CJ Butler and PB Byrne, are in posts at Armagh. Apart from specific joint projects, there is joint responsibility for the Irish Astronomical Journal, close co-operation in determining the affairs of the Astronomical Science Group as part of the Irish Astronomical Society, and a joint scheme for inviting European astronomers to visit both Armagh and Dunsink.

B COSMIC RAY SECTION

1 STAFF AND SCHOLARS

Senior Professor:

C O Ceallaigh

Professor:

K Imaeda

Assistant Professors:

D O'Sullivan and A Thompson

Experimental Officer:

J Daly

Technical and Clerical Staff:

Mrs E Clifton; Miss H O'Donnell; Miss E Rankin;
Miss M Cahill; Miss U Donnelly (to 31 January);
Miss A Grace (from 3 January); Miss B Kinnane
(from 20 February).

2 RESEARCH WORK

Ultra Heavy Cosmic Ray Nuclei: C O Ceallaigh,
D O'Sullivan and A Thompson with J Daly.

In January 1978 the US National Aeronautics and Space Administration (NASA) selected a DIAS/ESTEC proposal for the first Long Duration Exposure Facility (LDEF) mission. The proposal was submitted jointly by the Cosmic Ray Section of DIAS and the Cosmic Ray Division of the Space Science Department of ESTEC/ESA.

The DIAS/ESTEC experiment will be the largest of the four scientific projects selected for the LDEF mission and was chosen by NASA in world-wide open competition from over two hundred American and International proposals. D O'Sullivan and A Thompson are NASA appointed joint Principal Investigators for the project on which work will continue for approximately seven years. V Domingo and P Wensel are the ESTEC co-investigators. The commercial value of the facilities granted by NASA to the DIAS/ESTEC collaboration total approximately ten million dollars (1977 US dollar prices). Environmental test systems and engineering facilities in Holland and Germany have been provided by ESA.

The main objective of the experiment is a detailed study of the spectrum of ultra-heavy cosmic ray nuclei from Zinc ($Z=30$) to Uranium ($Z=92$) and beyond, using solid state track detectors. Special emphasis will be placed on the relative abundances in the region $Z > 65$, which is thought to be dominated by r-process nucleosynthesis. Subsidiary objectives include the study of the cosmic ray transiron spectrum and a search for the postulated long-lived super-heavy nuclei ($Z > 110$), such as ${}_{110}\text{S}^{294}$, in the contemporary cosmic radiation. The detection of such nuclei would, of course, have far reaching consequences for nuclear structure theory.

A central theme of the experiment is the utilisation of LDEF's large area-time factor to obtain a uniform sample of ultra-heavy cosmic ray nuclei in the region $Z > 65$, of sufficient size to increase the world data by a significant degree. At present there are two samples of ultra-heavy nuclei which are used as reference material for testing astrophysical theory; that of the Bristol-Dublin Collaboration (Balloon flights) and that of the Berkeley Group (Skylab). Each sample contains about a hundred events.

The LDEF will be launched from the Kennedy Space Centre by the Space Shuttle and placed in a circular orbit of ≈ 560 km altitude and 28° inclination. The craft will be left in orbit for approximately one year and will then be recovered by a second mission of the Space Shuttle. The present target date for launching is early 1981.

Preparation and testing of the DIAS/ESTEC payload started during the year and is at present well under way. Sets of four detector stacks will be mounted in an eccofom matrix and placed in cylindrical aluminium pressure vessels. The sixteen LDEF trays allotted for our experiment will each house three of these cylinders, the total amounting to an exposure area of $\approx 20 \text{ m}^2$ and a weight of ≈ 1300 kg.

Models of the cylinders were constructed to develop handling and welding techniques and tested in accordance with the acceptance levels set out by NASA. Mass spectrometer and Helium sniffer leak tests performed following extreme conditions of both evacuation and overpressure indicated that the mechanical design was successful. Indeed in burst tests performed on the test models burst pressures of up to ≈ 20 atm were recorded.

Following the construction of a prototype consisting of a tray and three cylinders loaded with detector stacks and eccofom, sinusoidal and random vibration testing was performed on the assembled unit. The initial results indicated that little modification of the prototype would be necessary when the final specifications will be decided at the Final Design Review meeting with NASA in 1979.

The thermal design for the DIAS/ESTEC experiment and its important effect on the LDEF as a whole was the subject of much investigation during the year. A satisfactory solution obtained by thermally decoupling our experiment trays from the LDEF structure and using 5 mil aluminised teflon as a thermal cover has been accepted by NASA. Acoustic tests on two specimen covers showed that exposure to sound pressures above the required test levels did not cause any damage. The cost of testing to date (approximately 200,000 dollars) has been covered by ESTEC.

During the year a considerable research effort was directed towards the development of a new polymer track detector based on CR-39 (allyl diglycol carbonate). Its predominant characteristic is a very low registration threshold ($Z/\beta = 20$) and it has, potentially, very high resolving power. By using CR-39 to complement Lexan polycarbonate for cosmic ray exposures it should be possible to study relativistic nuclei in the lower charge regions, down to Iron and below. Another field of work during the year was the investigation of the nuclear track response of Lexan as a function of specific environmental conditions which could occur during a long term exposure in space.

The work with CR-39 and with Lexan required heavy ion exposures at the Manchester Linac (10 MeV/N) and at the Bevalac (200 MeV/N and 2.0 GeV/N). A great deal of progress has been made and some of these studies are continuing in collaboration with Bristol University.

It should be noted that Bevalac users are now (since August 1978) charged for heavy ion exposures. However, NASA will cover the cost of any DIAS exposures which are relevant to the LDEF work.

An extended study of the primary cosmic ray transcobalt region in collaboration with Bristol University was initiated during the year. Within the limitations of the available statistics there is general agreement with solar system abundances in this region. However, the situation is very uncertain and much more work in this area is required.

Experimental Study of Hadronic Matter Produced in Very High Energy Nucleus-Nucleus Collisions

Application of the Quaternionic Formulation to Tachyons and Superluminal Transformations: K Imaeda

During the course of a visit to Japan in 1977, K Imaeda had many fruitful discussions with members of the Japanese Emulsion Groups on the feasibility of an experimental study of hadronic matter produced by very high energy nucleus-nucleus collisions using cosmic rays or accelerator beams. An experimental collab-

oration has been proposed and discussed in detail with two Japanese emulsion physicists from the Institute of Cosmic Ray Research of the University of Tokyo, who visited the Cosmic Ray Section during the summer of 1977. A realistic appraisal of the problems of funding and available man-power seemed to indicate that, in the present state of our finances, the collaboration could not be set-up. However, if the situation were to change it is felt that the proposal is important and merits consideration.

1) High-Energy Nuclear Interactions

A theoretical study has been continued of hadronic matter produced in multiple particle production through very high-energy nucleus-nucleus collisions. The problem of comparison of the theory with the available experimental results on nucleus-nucleus collisions has been examined. A principal aim has been the experimental verification of the existence of a critical temperature and the condensation phenomena of matter at high temperatures predicted by the theory of the statistical thermodynamics of a hadron gas developed earlier and already reported. The available experimental results are insufficient to provide a meaningful test of the theory. In particular, the data at very high energies ($> 10^{12}$ eV/N) are meagre.

2) Study of Tachyons

A theoretical study of the nature and the theoretical formulation of the behaviour of tachyons and superluminal transformations has been published already using the quaternionic formulation. To provide a firmer foundation for the theory of tachyons, a scrutiny has been made of the fundamental axioms of the theory of relativity in order to incorporate tachyons and superluminal transformations into the present physical theory. The special theory of relativity has been extended to include a complex space-time and complex Lorentz transformations so as to provide a natural justification for the hypothesis of the existence of tachyons. A communication theory between inertial observers, using light signals or superluminal signals has been examined with the aim of justifying the introduction of a complex space-time. The group nature of the superluminal transformation has been demonstrated.

3 WORKSHOP - J. Daly

Technical Activities, LDEF Mission

The former scanning-room of the Section was redesigned as an assembly area for the modules for the LDEF Mission, with particular emphasis on the problem of the maintenance of clean working conditions.

The problem of the construction of the Eccofoam inserts was resolved by having rough mouldings manufactured by RMP Plastics,

Gosport, Hants. Suitable machining techniques were developed for finishing the mouldings.

Twelve prototype detector stacks were constructed and brought to ESTEC, Noordwijk, Holland. These were placed in three sealed aluminium cylinders, which were successfully subjected to stringent pressure and vacuum tests. Vibration tests were subsequently carried out by technicians of the ESTEC Group on a complete flight-tray which included the above cylinders. Examination during a subsequent visit to ESTEC revealed no evidence of disturbance or damage to the detectors in the stacks.

In view of the satisfactory results, work was commenced on the production of the main detector payload.

The members of the technical staff worked on the initial cutting and marking of the plastic material for the detector stacks.

During the year general maintenance of microscope and other equipment was carried out.

4 EXTERNAL ACTIVITIES

Visits to the European Space Centre in Holland (ESTEC) were made on business concerning the LDEF mission on the following dates:

Professors O'Sullivan, Thompson, February 2 - 5

Mr J Daly, February 16 - 19

Professors O'Sullivan, Thompson and Mr J Daly, May 15 - 18

Professors O'Sullivan, Thompson and Mr J Daly, October 4 - 7

Mr J Daly, November 12 - 14

Working visits to Manchester heavy ion accelerator and Bristol Physics Department in furtherance of detector development were made by Professors O'Sullivan and Thompson for a total of eleven days during the year. They also made two working trips to the Bevalac at Berkeley for exposures to the high energy heavy ions recently developed there and for preliminary design review meetings with NASA and ESA representatives in Washington (April 11 - May 2) and (November 20 to December 4).

As a member of the Scientific and Technical Committee of Euratom C O Ceallaigh attended a meeting in Brussels, Belgium (16/17 February). He has served his five year period on the Scientific and Technical committee and the Groupe de Liaison Fusion, consequently, is no longer a member of these bodies.

5 LECTURES

Dr D O'Sullivan delivered a series of 16 lectures on Nuclear and High Energy Physics to final year Physics students at University College, Galway and read a paper entitled 'Cosmic Ray Studies in Space' at the Institute of Physics Annual Meeting.

The Statutory Public Lecture entitled 'Cosmic Gamma Rays - A New Window on the Universe' was delivered by Professor Arnold Wolfendale FRS at Trinity College, Dublin on 12 December 1978.

6 PUBLICATIONS

Published:

C Ó Ceallaigh, D O'Sullivan and A Thompson:

High Resolution Study of Nucleonic Cosmic Rays with $Z > 34$.
Proceedings of the 9th International Conference on Solid State Nuclear Track Detectors, Pergamon Press, December 1978.

Measurement of the Cosmic Ray Element Abundances in the Region from Nickel to Krypton using Lexan Track Detectors.
Proceedings of the 9th International Conference on Solid State Nuclear Track Detectors, Pergamon Press, December 1978.

In preparation:

C Ó Ceallaigh, D O'Sullivan and A Thompson

Track Response in CR-39 as a function of polymerisation.

Track Response in Lexan as a function of Oxygen environment.

Charge and Energy Spectra of Very Low Energy Cosmic Ray Nuclei.

Charge Spectra of Transcobalt Cosmic Ray Nuclei.

In the Press:

X Imaeda:

Quaternionic Formulation of tachyons, superluminal transformations and a complex space-time in Nuovo Cimento.

C GEOPHYSICS SECTION

1 STAFF AND SCHOLARS

Senior Professor:

T Murphy

Professor:

AWB Jacob

Research Assistant:

Vacant

Experimental Officer:

JC Davies

Technical and Clerical Staff:

K Bolster; Miss A Byrne; Miss E Ryan; Miss V Ward and
G Wallace.

Field Assistant:

F Williams (June 5 - July 28)

2 RESEARCH WORK

a) Magnetics:

Three cruises shared with the Geological Survey were undertaken on the Research Vessel Lough Beltra using a marine magnetometer.

The first area consisted mainly of Galway Bay with one triangular course northwards off the Galway coast to abreast of Inishboffin southwestwards until west of Inishmore and hence eastwards. The magnetic field in the Bay is complex particularly near the northern coast possibly due to basic rocks similar to those which outcrop on Gorumna Island. There is an abrupt decrease west of the latter. Over the rest of the area the sources of the anomalies are deep and the field southwestwards of the Aran Islands becomes featureless. The overall pattern of contours would seem to confirm the extension of Galway Granite which itself is magnetic, postulated from earlier gravity work.

A land survey along the coast was carried out later in order to connect with geophysical and geological investigations conducted by various other agencies.

The other area was a continuation of last years work filling in the gap between the airborne survey of the United Kingdom and the Irish Coast. Of the interesting anomalies encountered some close to Median Line would indicate that Tertiary intrusives occur.

The navigation difficulties on the Lough Beltra were somewhat ameliorated by the addition of a gyro compass and log but are still the source of much uncertainty.

It also became apparent that the vessel produced a magnetic disturbance at a greater distance than was anticipated. Not sufficient relevant data have been accumulated to allow an assessment of the error to be made and it is apparent that a special experiment will be necessary. This is planned to take place at the earliest opportunity.

A further difficulty arose due to the application of a correction for the diurnal variation. On some particular cruises in the Irish Sea it appears that the correction obtained from a base station ashore is too large. The cause is being investigated.

After last years work the magnetometer was returned to the makers for rectification. On return it still proved unsatisfactory but was used on the Galway Survey. Later it was exchanged for a completely new one and this proved quite satisfactory on the Irish Sea Cruise.

b) Meteorology:

Routine observations of the meteorological elements were continued throughout the year, autographic records tabulated and the results published.

Rainfall records were compiled by K Bolster for a statistical study carried out by Professor O'Ceallaigh of the Cosmic Ray Section.

c) Gravity:

The publication of gravity data mentioned in last years report was put back until the replacement computer has been equipped with a plotter.

d) Seismology:

Seismic Network

Recording on magnetic tape was continued at DCN (Croghan Hill, Co Offaly) from the start of the year but the telephone line from DDK (Dunsink) to Merrion Square was out of action until mid-March. Apart from a few short breaks DDK has been

in operation since then. Permission (provisional) for radio links was finally granted in May and we were able to go ahead with preparation of the sites and the installation of radio transmitters and receivers. The transition from a single tape-recorded station to a triangular network (DKM, DCN, DMU) was achieved in November. The output from single vertical seismometers at DCN and DMU is frequency modulated and telemetered via UHF radio links to DKM (near Dublin) where it is recorded on a 14 channel tape recorder together with 3 component data observed at DKM itself, time from a crystal controlled time encoder in the recorder, and a continuous time signal transmitted by MSF Rugby (60 kHz).

There have been a number of interesting events during the year and these include earthquakes in the Kintail area of NW Scotland, an event in the Irish Sea (Anglesea area) and the damaging earthquake in South Germany on 3 September. All these events, plus very many quarry blasts in various parts of the country, were recorded at only two stations. The increase to four has, for the first time, allowed us to start locating unambiguously many of the local sources we have observed earlier. These sources should be very useful in future investigations of seismic structure in the country. The most dramatic event observed so far by the whole network was the very large Mexican earthquake of 29 November. The signals recorded were very satisfactorily coherent.

Data have been submitted throughout the year to the earthquake centres in Colorado (NEIS), Strasbourg (CSEM) and Reading (ISC).

Discussions were held with the ESB during the summer and, as a result, a station is to be set up at Carnsore Point with an outstation near New Ross. The ESB are buying the equipment and building the installations and we will, with help from them, run the station and interpret the records. The new sites will enormously improve our ability to observe and locate any events that may occur in the Irish Sea.

Anisotropy in the Earth's lithosphere

Professor Jacob visited Californian Seismological observatories in March to assess the availability of tape-recorded data for a study of anisotropy in the lithosphere. The situation seemed promising and a few paper records from one station were brought back. These were subsequently digitized by hand. In November he went back to make a more comprehensive collection of electronically digitized records from a network of 17 stations. 12 of these were operated by USGS, Menlo Park, one by UC Berkeley and 4 by the Livermore Laboratories. There were definite signs in some of the raw unprocessed data that polarization anomalies were present but further digital processing is needed before a detailed analysis can be carried out. Dr S Crampin, Edinburgh visited the Section and discussed the anisotropy project.

Rathfarnham Castle Seismic Station

When the seismic station at Valentia became operative that at Rathfarnham was closed down and subsequently fell into disrepair. It was broken into, damaged and everything therein interfered with. After discussions with the Jesuit Order all the books and records etc which were in a poor state of preservation were transferred to the School. From these, seismic records going back to 1917 were studied and a preliminary catalogue made by Dr P Burton and Mr G Neilson of the Institute of Geological Sciences Edinburgh on behalf of the British Association. There is a proposal to have the records microfilmed.

An arrangement has been entered into with Fr Casey to transport the unique O'Leary Seismograph after some measurements and photographs have been taken to the Maynooth Museum for preservation.

3 LECTURES AND FIELD EXERCISES

A series of four lectures on Applied Geophysics was given by Professor Murphy to students of Surveying at the College of Technology, Bolton Street.

A series of eight lectures on geophysics for geological students was given during the Michaelmas term. Students from the two Dublin and the Cork colleges attended. Average attendance was twenty four. A field geophysical exercise for Trinity College students took place in June in the Ox Mountains district.

4 PUBLIC INQUIRIES

Academic and commercial concerns consult our data on various geophysical subjects and frequently call for advice. Gravity surveying for mineral prospects is continuing and magnetic data offshore for carbohydrate prospects was sought after.

5 EXTERNAL ACTIVITIES

- a) Professor Murphy attended the United Kingdom Geophysical Assembly at Liverpool in April and the Royal Society Working Group on Explosion Seismology, which followed.
- b) The European Association of Exploration Geophysics was held in Dublin in June and the staff attended.
- c) Professor Jacob attended the Royal Society Working Group on Explosion Seismology in London in October and the American Geophysical Union Annual Meeting in San Francisco in December.
- d) Professors Jacob and Murphy attended a preliminary planning meeting for an East West Seismic Profile across Ireland and

Great Britain held at Leicester in October.

6 PUBLICATIONS

A W B Jacob:

"LISPB - IV. Crustal Structure of Northern Ireland",
(1978), Geophysics. JR astr Soc, 54, 43-60 (with Bamford,
Nunn, Prodehl).

"Explosion Seismology in Central Europe-Data and Results"
(Book Review), Earth Science Reviews (1978), 14, 90-91.

INSTITIÚID ARD-LÉINN BHAILE ÁTHA CLIATH
(Dublin Institute for Advanced Studies)

Income and Expenditure Account
for the year ended 31 December 1978

<u>1977</u>			<u>1978</u>
£	<u>INCOME</u>	<u>NOTES</u>	£
622,100	Oireachtas Grants in Aid	1(a), 2	706,200
12,681	Sales of Publications	3	16,535
5,827	Vernam Hull Bequest	4	—
—	Fire Insurance Compensation	5	71,919
—	Summer School	6	2,803
9,848	Miscellaneous	7	13,685
<u>650,456</u>			<u>811,142</u>
	<u>EXPENDITURE</u>	8	
141,470	Administration		183,109
153,485	School of Celtic Studies		197,519
89,417	School of Theoretical Physics		100,323
227,511	School of Cosmic Physics		318,297
5,189	Adaptation of Premises		7,887
<u>617,072</u>			<u>807,135</u>
33,384	<u>SURPLUS</u> for the year	9	4,007

Notes 1 to 13 form part of these accounts

Signed: 

W. B. STANFORD
CHAIRMAN - COUNCIL OF THE INSTITUTE

28th September, 1979.

INSTITIÚID ARD-LÉINN BHAILE ÁTHA CLIATH
(Dublin Institute for Advanced Studies)

Balance Sheet at 31 December 1978

<u>1977</u>		<u>NOTES</u>	<u>1978</u>
£	<u>CURRENT ASSETS</u>		£
116,906	Cash on hands and at Bank		182,545
19,311	Debtors and Prepayments		22,639
<u>136,217</u>			<u>205,184</u>
	Less		
	<u>CURRENT LIABILITIES</u>		
32,532	Creditors and accruals		97,492
<u>103,685</u>	<u>NET CURRENT ASSETS</u>		<u>107,692</u>
	Represented by		
<u>103,685</u>	INCOME and EXPENDITURE - Accumulated Surplus	9	<u>107,692</u>

Notes 1 to 13 form part of these accounts

Signed: 

W. B. STANFORD
CHAIRMAN - COUNCIL OF THE INSTITUTE

28th September, 1979.

INSTITIÚID ARD-LÉINN BHAILE ÁTHA CLIATH
(Dublin Institute for Advanced Studies)

NOTES TO THE ACCOUNTS

1. Accounting policies

- (a) Oireachtas Grants-in-Aid: Income shown in the Accounts as Oireachtas Grants-in-Aid is the actual cash received in the period of the Account.
- (b) Furniture and Equipment: Expenditure on Furniture and Equipment is written off in the period in which it is incurred.
- (c) Publications: Expenditure on Publications is written off in the period in which it is incurred.

<u>1977</u>				
£		<u>2. Oireachtas Grants-in-Aid</u>	£	£
143,000	Administration	178,600*		
152,300	School of Celtic Studies	168,000		
87,400	School of Theoretical Physics	100,000		
235,400	School of Cosmic Physics	255,600		
4,000	Adaptation of Premises	<u>4,000</u>		<u>706,200</u>
622,100				
	* £4,000 was transferred from Administration to Adaptation of Premises.			

£	<u>3. Sales of Publications</u>	£	£
12,556	School of Celtic Studies	16,382	
19	School of Theoretical Physics	124	
106	School of Cosmic Physics	<u>29</u>	<u>16,535</u>
12,681			

4. Vernam Hull Bequest

Project to be financed by this bequest has not yet been decided on. No money was expended from this fund in 1978 (value at 31 December 1978 was £6,884 - included in balance under School of Celtic Studies).

5. Fire Insurance Compensation

(a) Contents

Insurers paid £53,518 to the Institiúid in 1978 in settlement of "contents" claim arising from a fire at Dunsink Observatory in 1977. Expenditure to 31/12/1978 by the

INSTITIÚID ARD-LÉINN BHAILE ÁTHA CLIATH
(Dublin Institute for Advanced Studies)

NOTES TO THE ACCOUNTS

Institiúid amounted to £29,870 and the balance on hands at 31/12/1978, £21,848, is included in the balance of the School of Cosmic Physics.

(b) Buildings

An interim payment of £48,000 was made by the Insurers in 1978 towards cost of re-instatement of the building destroyed by fire.

Expenditure on buildings amounted to £14,653 in 1978 & £3,748 in 1977. The balance on hands, £29,599, is included in creditors at 31/12/1978.

6. Included in this amount are fees from participants, grant of £300 from the Cultural Relations Committee of the Department of Foreign Affairs and a grant of £120 from Bórd Fáilte.

1977

£	7. <u>Income</u>		
9,209	<u>Miscellaneous:</u> Administration	13,035	
611	School of Celtic Studies	639	
28	School of Theoretical Physics	11	
	School of Cosmic Physics		13,685
9,848			

8. Analysis of Expenditure

1977		Total	Administration	School of Celtic Studies	School of Theoretical Physics	School of Cosmic Physics
£		£	£	£	£	£
366,512	Salaries, Wages & Superannuation	438,052	76,977	117,449	80,762	182,874
29,153	Scholarships	28,643	-	11,008	14,646	2,989
2,700	Honouraria	2,700	-	2,090	-	150
17,889	Library	21,262	-	4,387	8,892	7,983
45,008	Publications (Note 1c)	57,436	855	49,743	3,351	1,487
40,754	Furniture & Equipment (Note 1b)	51,576	3,756	582	4,352	42,886
86,581	General Administration (Note 1d)	84,818	84,818	-	-	-
20,381	Travelling & Survey Expenses	30,819	331	3,716	3,045	23,707
689	Summer School, Symposium & Seminar Expenses	5,646	-	3,125	321	-
11,597	Consumable Equipment	12,968	-	-	-	12,968
2,705	Special Commitments (Note 11)	-	-	-	-	-
15,363	General Expenses	21,305	3,699	3,459	2,754	11,393
	Fixed Replacement:					
1,800	"Contents" (Note 5)	29,870	-	-	-	29,870
2,748	Buildings (Note 5)	14,653	14,653	-	-	-
611,883	Sub-Total	799,248	182,109	187,318	100,322	318,297
5,189	Adaptation of Premises	7,887				
617,072	Total	807,135				

INSTITIÚID ARD-LÉINN BHAILE ÁTHA CLIATH
(Dublin Institute for Advanced Studies)

NOTES TO THE ACCOUNTS

9. <u>Surplus/Deficit Position</u>	Balance 1/1/78 £	Year to 31/12/78 £	Balance 31/12/78 £
Administration	26,516	22,927	49,443
School of Celtic Studies	26,352	(9,695)	16,657
School of Theoretical Physics	3,183	(188)	2,995
School of Cosmic Physics	47,548	(9,150)	38,398
Adaptation of Premises	86	113	199
	<u>103,685</u>	<u>4,007</u>	<u>107,692</u>

This surplus is available towards meeting the Institute's expenditure on commitments outstanding at 31 December 1978 (see Note 13).

1977 £	10. <u>General Administration Expenses</u>	£	1978 £
35,466	Rent, Rates & Insurance	36,496	
10,157	Premises Maintenance	25,482	
8,338	Postage & Telephones	10,027	
11,686	Fuel, Light & Power	11,435	
934	Sundry Supplies	<u>1,378</u>	84,818
66,581			

11. Special Commitments

2,705	Balloon Flight - Special emulsion purchased for use in long duration test flight - no commitment in 1978	—
<u> </u>		<u> </u>

12. Superannuation

Expenditure arising under superannuation schemes is met out of Oireachtas Grants-in-Aid in the year of payment.

13. Outstanding Commitments

The estimated cost of commitments outstanding at 31 December 1978, exclusive of Current Liabilities shown on the Balance Sheet, is as follows:

31/12/77 £		£
28,100	Administration	48,949
26,350	School of Celtic Studies	14,649
2,960	School of Theoretical Physics	1,380
<u>47,440</u>	School of Cosmic Physics	<u>47,604</u>
104,850		<u>112,582</u>

Report of the Comptroller and Auditor General

I have examined the foregoing Income and Expenditure Account and Balance Sheet which, as required by Act um Institiúid Ard-Léinn 1940, are in the form approved by the Minister for Education with the concurrence of the Minister for Finance. I have obtained all the information and explanations which I have considered necessary for the purpose of my audit.

In my opinion:-

- (a) proper books of account have been kept by An Institiúid and the Income and Expenditure Account and Balance Sheet are in agreement with them, and
- (b) the Income and Expenditure Account and Balance Sheet, together with notes 1 to 13, give, respectively, a true and fair view of the transactions of An Institiúid for the year ended 31 December 1978 and of the state of its affairs on that date.

SEÁN Mac GEARAILT
Comptroller and Auditor General

8 Deireadh Fómhair 1979.